

Conclusion. The apical portion of the uterine horn is not essential for the evacuation of the uterus in the dog, rabbit and rat.

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Effect of Gonadotropic and Oestrogenic Hormones on Regenerating Feathers of Weaver Finches (*Pyromelana franciscana*).*

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The seasonal change of plumages in certain birds has long attracted the attention of ornithologists though until recent years little has been accomplished in the analysis of factors in control of this periodicity. The literature shall be considered in a following paper, which will deal with the many correlated features of seasonal variation in different species. The present paper reports only some experiments on the effects of certain hormones on the breast feathers of the African orange weaver finch (*Pyromelana franciscana*). The females carry a hen plumage throughout the year. The breast appears white in the midventral region, as in Fig. 1, left breast, turning into a light buff laterally. The base of the feathers, always invisible in the well arranged plumage, is of a dark gray, due to the deposit of melanin granules (Fig. 3, top left). The males also have this hen plumage outside of the breeding season. It is identical with the plumage of the female to such an extent that it is impossible to tell the sexes apart, unless an occasional nuptial feather may be found that was not shed during the preceding molt. With the approach of the breeding season the males pass through an incomplete molt, shedding only the "small plumage" which is replaced by a brilliant cock plumage in orange-red and black colors. The breast feathers are black (Fig. 1, right breast). Along with the color, the size and shape of the feathers also change (Fig. 4, lower row, right). Regenerating feathers assume the cock type during the active breeding season (about June 15 to September 30) and the hen type during the remainder of the year. Castrated males and females show in principle the same seasonal periodicity as normal

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males (Witschi¹) though molting and regeneration are more irregular and the plumage of castrates outside the breeding season is sometimes of an intermediate type.

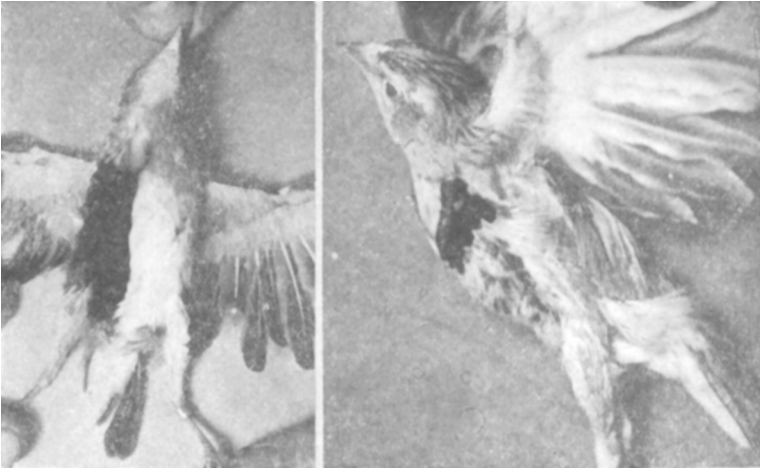


FIG. 1.

Castrated male (OW86) in the quiescent season. Hen plumage except for the right throat, breast and abdomen, where under the influence of injections of gonadotropic hormone (preg. mare serum, 20 DRU, 16 days) a cock plumage has regenerated.

FIG. 2.

FIG. 2.

Castrated male (OW91) with areas 1 and 2 on breast showing regeneration of feathers under conditions described in text.

The cock plumage, obviously is not determined by testicular hormone, since castration does not prevent its appearance during the breeding season. Indeed it has been found that injection of various doses of male sex hormones does not interfere with regeneration of hen feathers during the quiescent period (6 cases). On the other hand, the cock plumage can not be considered as the neutral phase, since it is replaced by the hen plumage after the breeding season.

Continuance of periodicity in castrates suggested that the cock plumage appears in direct response to a high level of gonadotropic hormones. Hypophyseal extracts and serum of pregnant mares were, therefore, injected in 15 different cases (3 males, 1 female, 9 male castrates, 2 female castrates) during the season of sexual quiescence. Feathers regenerating under the influence of these hormones were of the cock type (Fig. 1, right breast). Hypophyseal extracts were administered at the rate of one to 2 rat units

¹ Witschi, E., *Wilson Bull.*, 1935, **47**, 177.

per day. The change to the cock type was only incomplete, while with this dosage ovaries and testes showed very marked stimulation. The pregnant mare serum containing about 20 daily rat units caused a complete reversal to the cock type in all injected males (2) and castrates (8). A study of the effect of different fractions of hypophyseal extracts is now under way.

In bird OW91 (Fig. 2) feathers of the breast region were plucked at intervals of 4 days. The first area, posterior left breast, was deplumed 8 days before starting the injections; the second area, anterior left, 4 days before injections; the third area, posterior right (not visible on the figure), was deplumed on the day when the first injection was given. Injections of pregnant mare serum (20 DRU) were given over a period of 8 days. On the third day the darkening color of the feather papillae indicated melanin

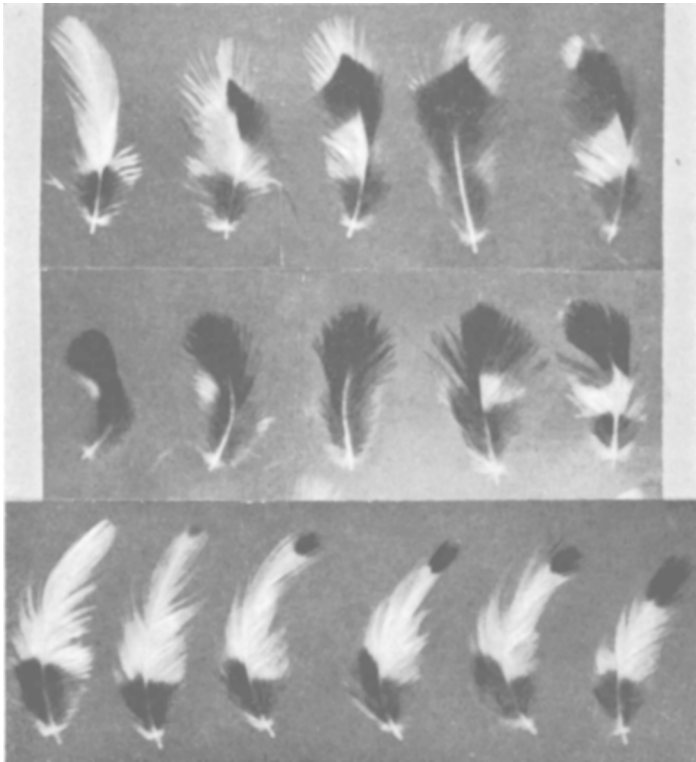


FIG. 3.

Single feathers of castrate OW91 from area 1 (top row), area 2 (middle row) and area 3 (bottom row). Feathers at the left ends of the top and bottom rows are of the pure hen type, grown before and after the period of injections. See text.

production. The photograph (Fig. 2) was taken a week after the last injection. The first deplumed area appears mottled, the second area black and the third, not visible area is white with black dots. Plucked feathers, as shown in Fig. 3, permit one to reconstruct the course of feather regeneration quite completely. After removal of a feather it takes at least 3 days for the feather germ to reorganize and to form a new papilla. In the first area, feathers, therefore, have a growth period of about 4 days before the beginning of injections. During this period, the tip of the feather forms according to the hen type (4 last feathers in top row; the first one represents the hen type of the feathers which were removed from this bird). In the second area active growth starts only in few feathers prior to the injections. Therefore, we find that in this region the feathers have black tips. The tips of these feathers are blunt as is characteristic of the cock plumage (Fig. 3, middle row). During the following 8 days feathers in both areas grow "cock-type". Shortly after the last injection they resume, however, the hen type mode of differentiation, so that the base of nearly all feathers is again in conformance with the season. Quite interesting is also the reaction observed in the third area. The start of regeneration is obviously retarded due

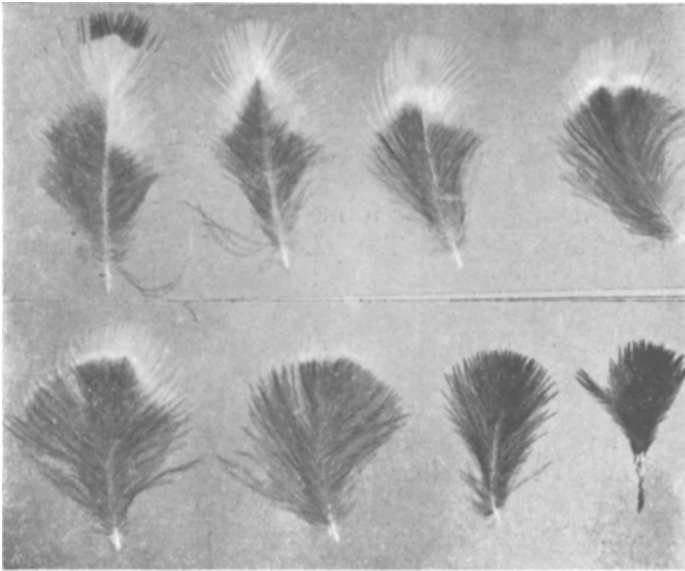


FIG. 4.

Single feathers from the breast of male OW100, grown during the breeding season and showing the effect of a 6-day period of injections of theelol (see text). The last 2 feathers are of the pure cock type, regenerated after injections had been discontinued.

to the disturbance caused by the daily injections. Only the tips of the feathers show, therefore, the full effect of the injections (Fig. 3, bottom row). Some seem to have grown for 2 or 3 days under gonadotropic control (feathers at right end of the row); others show only slight modifications at the very tip, and many have grown entirely after the injections had been discontinued. Thus the feather at the left end of the bottom row (Fig. 3) shows that differentiation reverts to the hen type soon after the last injection.

The realization of the rôle of the gonadotropic hormone in determining the cock plumage raises the question why the female retains hen feathers during the breeding season. No doubt the gonadotropic hormone reaches also a high level in females, as indicated by the growth and ovulation of eggs and the plumage change in castrated females. Injection experiments prove that in *Pyromelana* as in the domestic fowl the cock feathering is inhibited by ovarian hormones. Three males and 5 castrates which had started to assume their breeding plumages were used in this experiment. Injections were given twice daily for a period of 6 days. The crystalline hormones were dissolved in weak alcohol. One group was given 20 RU (10γ) per day of theelin, the second group was given 20 RU (1.25γ) per day of dihydro-theelin and the third group obtained 4 RU (40γ) per day of theelol. In every case feathers regenerating during these 6 days differentiated according to the hen type instead of the cock type, as would correspond to the season. Fig. 4 shows some feathers of the male OW100, of the group which obtained theelol injections. The first feather in the upper row had started to regenerate shortly before the injections; its tip is black but it is followed by the parts formed under the influence of theelol, which are of the hen type. The following 5 feathers started under the influence of the injections; the tip is henny, but the lower parts reverted to the cock type after discontinuation of the injections. The width of the light edge indicates to what extent regeneration took place within the 6-day period of injections. The last 2 feathers regenerated entirely after this period. They represent again the pure cock type. It is interesting to note that the reversion to the structure of the cock feather precedes distinctly the appearance of the characteristic melanin coloration.

These experiments lead to the conclusion that (1) the hen plumage represents a neutral, basic condition; (2) the cock plumage is induced by a high level of gonadotropic hormone, and (3) the ovarian hormones offset the inductive effects of gonadotropic hormones on the feather type. It is a possibility worth experimental investigation, that the same mode of control may determine feather

patterns in the domestic fowl (brown leghorn), except that hypophyseal activity does not seem to suffer such pronounced seasonal variations as in *Pyromelana*.

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Effect of Thyro-Parathyroidectomy in New Born Rats.*

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Rats are particularly adapted for experiments on the effect of very early ablation of the thyroid because they are very immature at birth, and have had a developed thyroid only the last 3 days *in utero*.¹ No previous reports on mammals have dealt with such early ablations. The present experiments deal with the removal of the thyro-parathyroid apparatus in young rats on the first or second day of life. A very few animals were also operated on the seventh and fourteenth days of life. Complete removal is extremely difficult because of the gelatinous consistency of the infantile tissues. Every animal here reported was checked for completeness of removal by microscopic examination of serial sections of the tracheal region made at autopsy. This check was found to be absolutely necessary since in many stunted animals microscopic remnants were found. These will be treated separately as "incompletes."

Of 486 rats thyro-parathyroidectomized on the first or second day of life, 167 survived the critical period of the first post-operative week. Animals were sacrificed at various intervals after data on growth had been secured. The 167 survivors were autopsied and 107 of them have been examined for completeness of removal. Twenty of these show no remnant of the thyro-parathyroid apparatus. Of the 46 animals operated on at 7 or 14 days, verifying examination of the operative field had been completed on only 5. In an operated control series of 38 animals, the thyro-parathyroids were removed on the first day and the glands re-implanted in the same animal²; 30 survived beyond the critical week; 28 showed normal

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¹ Kull, Harry A., *Anat. Rec.*, 1926, **82**, 133.

² Salmon, T. N., and Severinghaus, A., *PROC. SOC. EXP. BIOL. AND MED.*, 1936, **34**, 251.