CHAPTER 7

CERTAIN CYCLIC CYTOLOGICAL CHANGES IN THE PITUITARY GLAND OF THE MIGRATORY STARLING, STURNUS ROSEUS (LINNAEUS)

In recent years much work has been done on the mammalian pituitary with a view to a better understanding of the relationship between the six well established hormones of the anterior pituitary and the various cell types in the gland. Theoretically, each hormone is produced by a morphologically distinct or at least histochemically distinct type of cell. One of the methods of approach has been to produce experimental conditions in which alternations in the specific content of the hormone could be correlated with alternations in the number and secretory activity of a particular cell type. This approach has been feasible through the application of specific staining methods which account for the morphological, cytological or biochemical differences among the various cells.

The chemical composition of the six anterior pituitary hormones is fairly well established (Li and Evans, 1948; Hays and Staelman, 1955). The growth hormone (GH), adrenocorticotropic hormone (ACTH), and luteotropic hormone (LTH) are simple proteins while the follicle stimulating hormone (FSH), lutéinizing hormone (LH) and the thyroid stimulating hormone (TSH) are mucoproteins, containing considerable amounts of carbohydrates. Human and rat pituitaries were studied by Wilson and Ezrin (1954) after treating the tissue with PAS-methyl blue in order to test the various pituitary cells for carbohydrates. This staining (Rennals, 1957; Hildebrand et al., 1957) is now an accepted cytochemical method

for the demonstration of the gonadotropes. According to several authorities, acidophils are believed to produce the growth hormone and prolactin (Luteotropin, LTH). There is as yet no complete agreement regarding the cellular sources of ACTH (Pearse, 1952a, 1952b). Farquhar (1957) in an electron microscope study has described the corticotropes of the adenohypophysis. Adams and Pearse (1959) have suggested that the S-mucoid cells (basophils) are responsible for corticotropin synthesis. Pickford and Atz (1957) in reviewing the literature on the subject has proposed that ACTH is produced by the acidophil cells. Chromophobes are believed to represent the inactive nonsecretory forms of both acidophils and basophils.

Dawson (1954a) with aldehyde fuchsin, azocarmine and the counterstain of Halmi (1952) has identified three types of basophils and two types of acidophils. The thyrotropes (Basophils) stain selectively with aldehyde fuchsin, the gonadotropic basophils gray-green or bright-green and the acidophils orange brown. Dawson (1954b) identified two types of acidophils in the anterior pituitary of rat, one stained orange and the other deep red.

In birds, little work has been done on the cytology and cytochemistry of the pituitary gland. According to Höhn (1961) the avian pituitary contains the following hormones which have been already isolated.

(1) The FSH which stimulates the ovarian follicles and in the males stimulates spermatogenesis in the testicular tubules.

(2) LH, so named because in mammals, it converts the ovarian

follicles into corpora lutea, which probably stimulate the interstitial cells of the testes, though some authors stipulate the presence of a separate interstitial-cell-stimulating hormone (ICSH). It has been isolated in chicken and reported in the pheasant pituitary (Höhn, 1961).

(3) ACTH which is known to stimulate the adrenal cortex of mammals is also present in the domestic fowl.

(4) TSH which stimulates the thyroid follicle has been isolated from the chicken pituitary.

(5) Prolactin produces milk in mammals and the crop-sac secretion in pigeons. It is also known to produce broodiness in chickens. The hormone has been isolated from the domestic fowl and is known to be more in brooding than in non-brooding fowls.

(6) Growth hormone of birds has not been isolated. Growth is found to be deficient in hypophysectomized birds but could be restored by prolactin administration. The mammalian growth hormone is found to have very little effect on the growth of chicken.

The success achieved in the isolation of some of the pituitary hormones in birds has been of considerable value in understanding the histophysiology of the gland. Earlier workers (Schooley and Riddle, 1938; Rahn, 1939; Rahn and Painter, 1941; Payne, 1942; 1943, 1944 and 1946; Wingstrand, 1951) classified the cells of the anterior pituitary in a very general way as acidophils, basophils and chromophobes. Payne (1946) carried out a long series of investigations on the cytology of the pituitary. He described two types of acidophils alpha 1 and alpha 2 of which

the former occupies the caudal part of the lobe and the latter the cephalic region. The alpha 1 cells are said to resemble the alpha cells of the mammals. One type showing basophilic properties is called by Payne (1944) as the T-cell since he suspected it to be concerned with thyroid function. The same author (1946) found an increase in the number and size of basophils along with testes growth in the chick, from the early embryonic stages to the adult. In the female he found the basophils increasing in number and size and their production persisted for some time even after egg laying. Breneman (1944, 1945) found an increase of gonadotropic hormonal content of the anterior pituitary when the testes increased in weight. During periods of broodiness, basophils practically disappeared from the pituitary and were replaced largely by small acidophils, which Payne (1943) called "broody cells". In birds it is generally agreed by most authors that the basophils produce the gonadotrope hormones. The function of the acidophils is not clearly defined, though Schooley and Riddle (1938) stated that the increase in number and size of the acidophils in the pigeon coincides with the period of greatest growth and prolactin production. Rahn (1939) also believed that the acidophils produced prolactin and also the growth hormone.

The investigations on the cytological changes in the anterior pituitary of migratory birds, are indeed very few. Wolfson (1945) has thrown much light on the cytology of the pituitary with special reference to the Golgi body activity in migratory birds at the time of migration. Considerable work has also been done on the hypothalamus of migratory birds in order to find out the

influence of neurosecretion on gonadial development under different photoperiodic conditions. However, little attention has been paid to the influence of the neurosecretion on the adenohypophysis.

Material and Methods

Birds of both sexes were collected every month from October to April. The brain was immediately dissected out intact with the pituitary and fixed in Bouin, Zenker formol and Susa respectively. Paraffin blocks were prepared and sections of 5 to 6 μ were cut and stained with various stains as mentioned below.

(1) Heidenhain azan stain (Gurr, 1956).

(2) Crossman's (1937) modifieation of the Mallory's triple stain.

(3) Aldehyde fuchsin staining of Halmi (1952).

(4) Performic acid-alcian blue method (PFAAB) of Adams and Swettenham (1958) modified by Adams and Pearse (1959).

(5) PAS-Orange G - methyl blue (Wilson and Ezrin, 1954).

(6) For demonstration of Golgi body Aoyama's method (1929) was adopted as described by Baker (1950). The material was taken in two sets. One in the last week of March and the other in the last week of April before a few days earlier to migration.

Observations

General morphology and histology:

The structure of the pituitary gland of the Rosy Pastor is not unlike that of the other birds described by Rahn and Painter (1941) and Wingstrand (1951). The pars distalis is an elongated cylindrical structure having a bend towards the hypothalamus and

forming a depression in the centre where the pars tuberalis and pars nervosa are connected. The pars intermedia is poorly developed and is hardly recognizable. The pars distalis is a large cellular part consisting of two histologically distinguishable regions the cephalic and the caudal as described in other birds (Rahn and Painter, 1941; Wingstrand, 1951). The pars nervosa is described in chapter 6. Pars tuberalis is a cellular structure having two distinct parts: one a very narrow cellular strip closely attached to the median eminence and the base of pars nervosa, and the other extending in between the pars distalis and the median eminence. The second part becomes more prominent as a result of increased number of blood capillaries towards the time of migration. The nerve fibres innervating this region are derived from the hypothalamus and the median eminence(Chapter, 6).

The cell types and their distribution:

Acidophils:

The pars distalis in the Rosy Pastor contains acidophils, basophils and chromophobes (Figs. 1,2,3 & 5) like those of the chicken anterior lobe (Rahn, 1939; Payne, 1942). The acidophil cells consist of two types (1) large Orange G cells containing a large nucleus and numerous cytoplasmic granules. These cells are scattered throughout the caudal region of pars distalis (Fig. 1). (2) Small Orange G cells with a few cytoplasmic granules and a small dense nucleus. These cells are in the majority in the cephalic region and in the small strip proceeding on the peripheral region

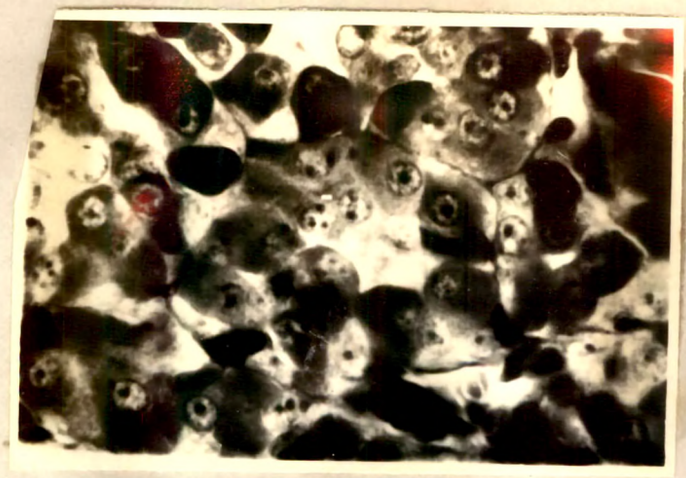


Fig. 1

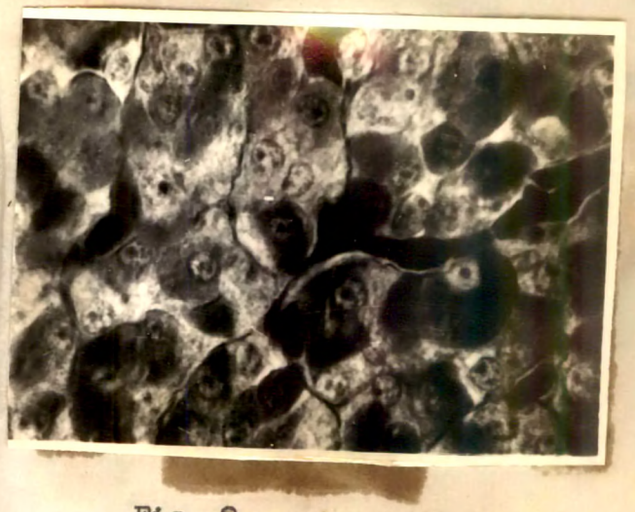


Fig. 2

50μ

Fig. 1. Photomicrograph of anterior pituitary of Rosy Pastor. Darkly stained are the acid fuchsin cells (acidophils), lightly stained basophil cells and chromophobes with less cytoplasm. (Stained with Crossman's stain)

Fig. 2. Deeply stained are FSH cells in the male towards the migratory phase (PAS-methyl blue).

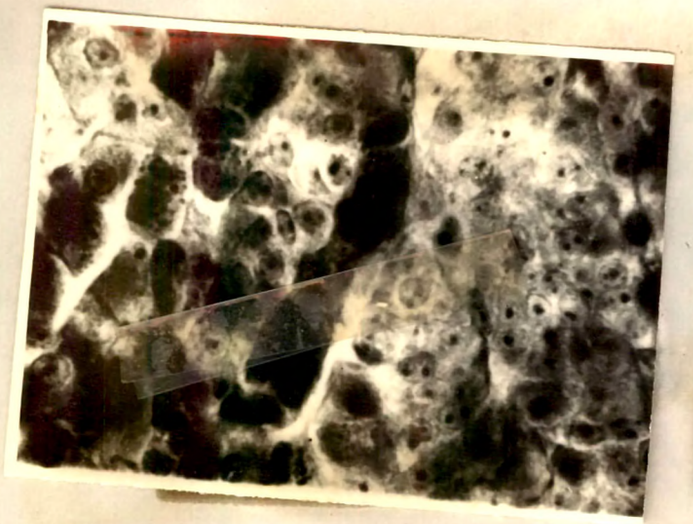
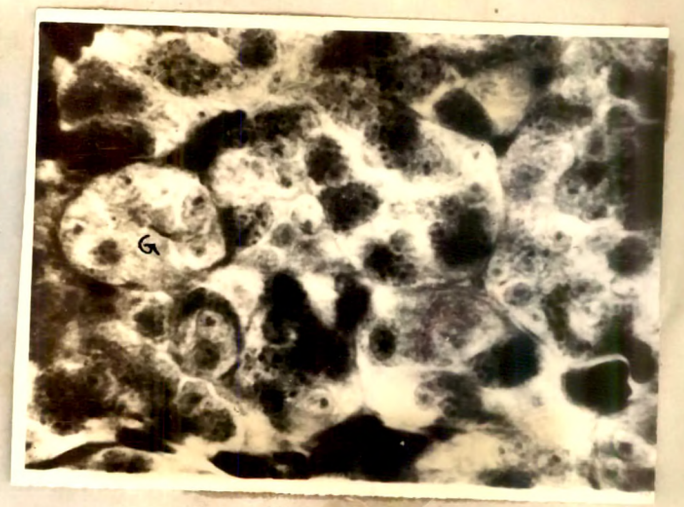


Fig. 3



50μ

Fig. 4

Figs. 3 & 4. Highly granulated darkly stained TSH cells towards the migratory phase. G:- Gonadotropic cells. (last week of March). Stained with aldehyde fuchsin.

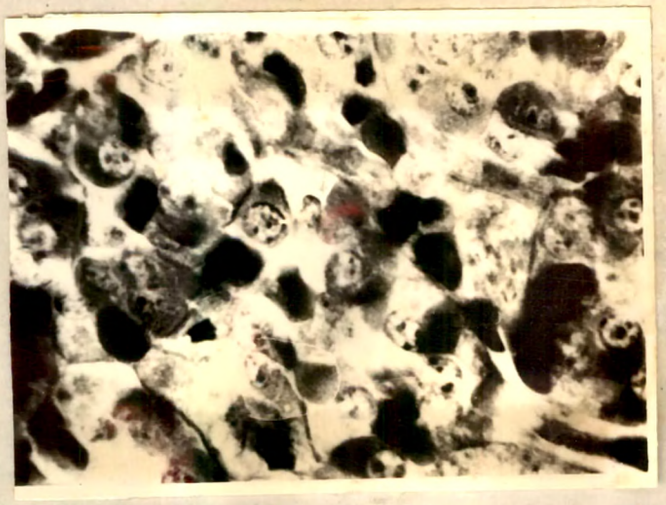


Fig. 5

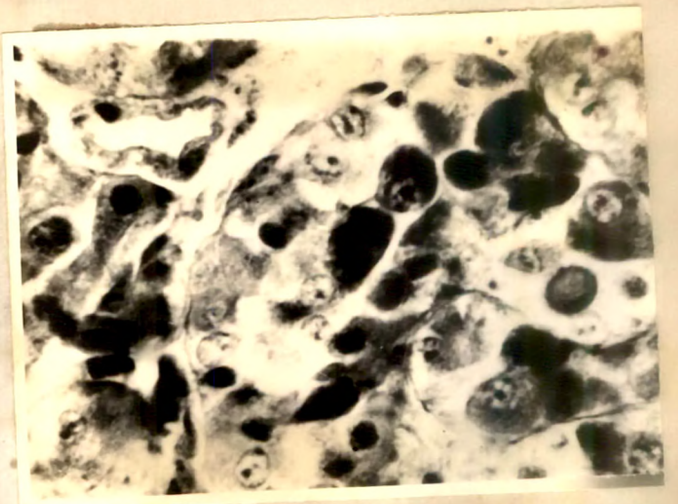


Fig. 6

50μ

Figs. 5 & 6. Degranulated TSH cells 3 or 4 days prior to migration. Chromophobe cells (lightly stained) have increased in number. (Aldehyde fuchsin).

Fig. 7

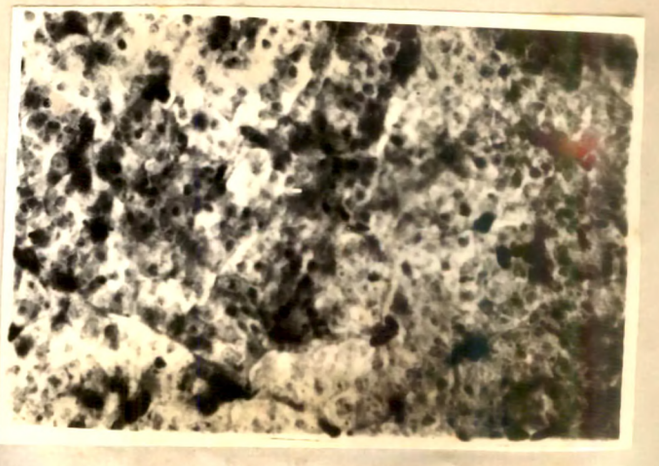


Fig. 8

100μ

Figs. 7 & 8. Anterior pituitary of Rosy Pastor stained with PFAAB method (S-cells darkly stained and R-cells are lightly stained). The distribution of S- and R-cells during the last week of March and April respectively. The S-cells have increased in number in fig. 8.

of the ventral side of the caudal lobe of pars distalis (Figs.1 & 10). In the caudal region however, the cells are very few in number. The large Orange G cells are similar to the A-1 cells and the small Orange G cells correspond to the cells of A-2 of Rahn (1939) and Payne (1942). The former have got greater affinity for the acid fuchsin stain than the Orange G stain. These cells also stain deep red with azo-carmine and green or blue (Figs. 9 & 10) with performic acid-alcian blue (PFAAB). The small Orange G cells stain very faint with azo-carmine and PAS respectively. With Crossman's stain these cells take up the Orange G colour whereas the large Orange G cells take up red or brownish colour which may be due to a combination of the staining with Orange G as well as acid fuchsin. Some of the large Orange G cells also take up green colour with the fast green of the Crossman's stain. The possible significance of this dual staining is discussed later.

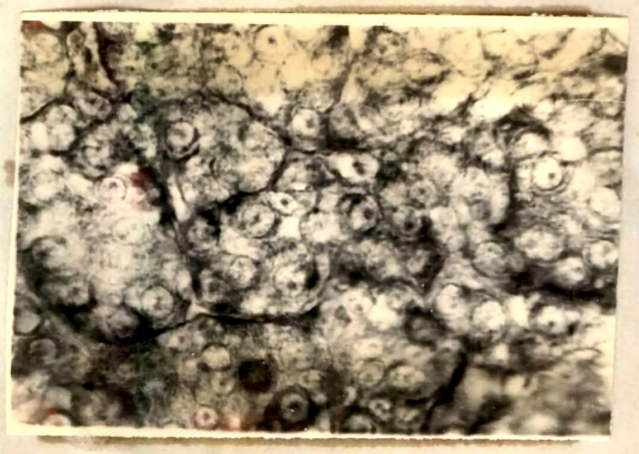
Basophil cells:

Generally three types of cells may be distinguished. With Crossman's staining the basophil cells stained blue or purple (Fig. 1). 1. Large basophils stained deep blue 2. small basophils purple 3. basophils (chromophobes) fewer in number but large and vesicular, light blue. All the three types of cells were scattered throughout pars distalis. (1) The first type (Figs. 1,2,3 & 5) stained deep blue (Crossman's) were faintly stained with PAS and deeply stained with aldehyde fuchsin (Halmi, 1952) and aniline blue of the Heidenhain azan stain. These cells were more in the caudal

region than in the cephalic. Generally in the central part of the caudal region, these cells prepondered over the faint blue basophil cells of Crossman and were generally round or oval containing very prominent and numerous aldehyde fuchsin-positive granules. In this respect they resemble the thyrotrope cells of mammals (Halmi, 1952; Thompson, 1960). (2) The faint blue basophil cells (Crossman's) were highly PAS-positive but alcian blue negative. They were smaller than the other basophil cells (Fig. 2) and mostly scattered throughout pars distalis but in the central part they were found in a concentrated manner. With PAS these basophils stained differently, purple and deep red. The purple cells were more numerous than the red ones. The former resemble the FSH cells and the latter the LH cells (Rennels, 1957; Hildebrand et al., 1957). (3) The vesicular light blue cells (Crossman's) stained faintly with aldehyde fuchsin and PAS. They contained little cytoplasm and some of them had few vacuoles. Most of these cells were very large chromophobic (Figs. 1,3,5 & 6) and generally found in the centre of pars distalis and very rarely in the peripheral region of the gland.

Seasonal changes in the Pars Distalis:

The small Orange G cells predominated in the cephalic region and also in the peripheral region of the ventral side of the caudal region. From October to March these cells were not very active (Figs. 7 & 9). Their cytoplasm was very little containing less acidophilic granules and showed poor reaction with PAS staining. At the time of migration these cells became larger and showed increase in the size of the nucleus as well as the number of cytoplasmic



50 μ Fig. 9

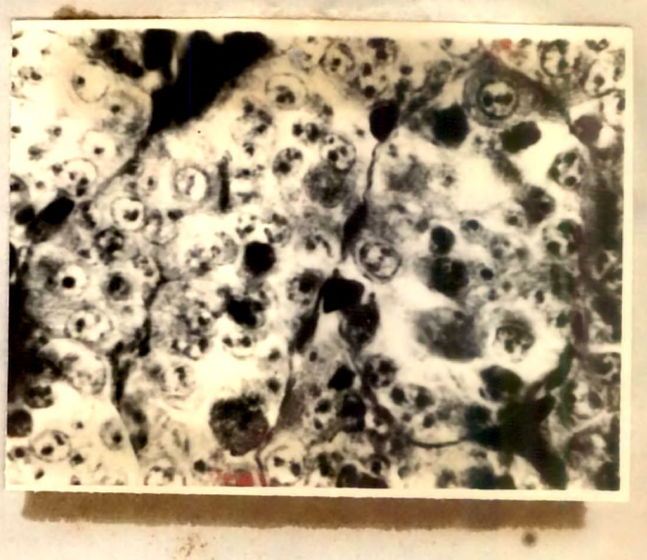
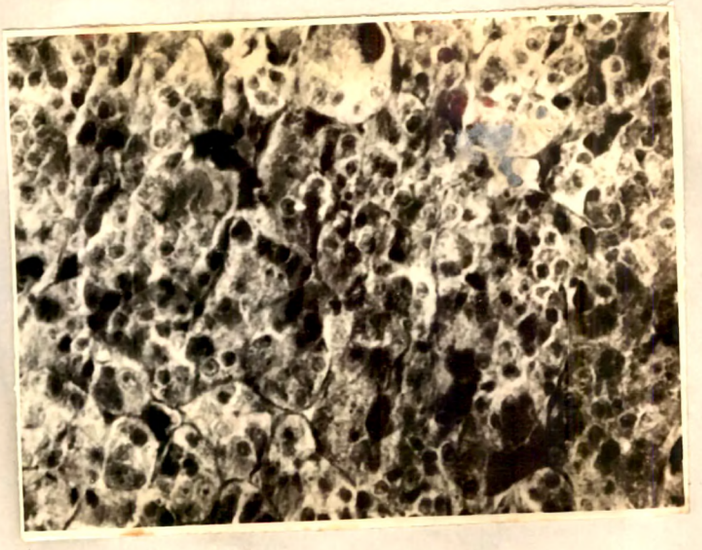


Fig. 10 50 μ

Figs. 9 & 10. Parts of figs. 7 & 8 magnified.



50 μ Fig. 11

Fig. 11. The increase in number as well as activity (increased staining) of R-cells before migration. Stained with PFAAB method.

granules (Fig. 11). Towards migration they became increasingly PAS-positive and also showed a magenta-red colour with PFAAB staining of Adams and Pearse (1959). However, some of the small Orange G cells remained small without any increase in the number of cytoplasmic granules or the intensity of the PAS-positive staining. The small Orange G cells which were present on the ventral side as well as the caudal region, also transformed themselves into PAS-positive cells.

The azo-carmine cells also stained faint with Orange G. In the post migratory phase (October) these cells stained very deep with azo-carmine and not with aldehyde fuchsin. In the months November to January some of the azo-carmine cells showed greater staining with aldehyde fuchsin and the cytoplasm became more prominent with bigger granules. A considerably greater increase in aldehyde-fuchsin staining was again recorded in April. With the PFAAB method two types of cells were distinguished, the blue or green cells (S-cells) and the red cells (R-cells), (Figs. 7 to 11). The former cells increased in the intensity of staining as well as in their number towards the time of migration. The red cells were few but towards migration they increased considerably in number and they also showed deeper staining. From these observations it appears that the azo-carmine cells are transformed into the S-cells as well as the aldehyde fuchsin-positive cells. It is well known that the aldehyde fuchsin-positive cells are the thyrotrope cells. In Rosy Pastor, these were more numerous and very prominent and also showed increased intensity of staining twice during the period under investigation, the highest increase being recorded in the

second phase (April) a week prior to migration. In these periods the cytoplasmic aldehyde fuchsin granules became bigger and numerous (Figs.3 &4), thereby denoting increased activity of these cells. About three or four days before migration these aldehyde fuchsin granules disappeared and the cytoplasm showed less number of granules and the cells thus seemed to be chromophobic (Figs. 5 & 6). As the activity of these cells increased some of the carmine-positive acidophils gradually changed to aldehyde-fuchsin-positive cells.

The gonadotropic cells in the pars distalis during the period October to late February did not show any striking change in activity. But with the testes fast developing, the purple cells (PAS-methyl blue) increased in number as well as in cytoplasmic granulation in them reaching the peak activity towards migration (Fig. 2). In the case of female, the activity of these cells increased gradually. The red cells (PAS-methyl blue) were only a few and also with fewer granules, without any spectacular seasonal changes as seen in males. However, three or four days prior to the migration of the females, which as mentioned earlier, takes place a few days after the males have already left, degranulation of these cells (aldehyde fuchsin cells) took place similar to what was observed in the males. After degranulation these cells were converted to chromophobes (Figs. 5 & 6).

Golgi body:

The Golgi bodies in the last week of March showed some sexual difference with regard to their size and staining reaction. In males the Golgi bodies were more prominent and bigger in size

Fig. 12

100 μ

Fig. 13

Anterior pituitary of Rosy Pastor stained for Golgi body with Aoyama's silver nitrate method

Fig. 12. Photomicrograph showing the Golgi body activity during the last week of March. The Golgi body of thyrotrope cells are very close to the nuclei and bigger in size.

Fig. 13. Golgi body a few days before migration showing bigger and extending to a larger area in the cytoplasm.

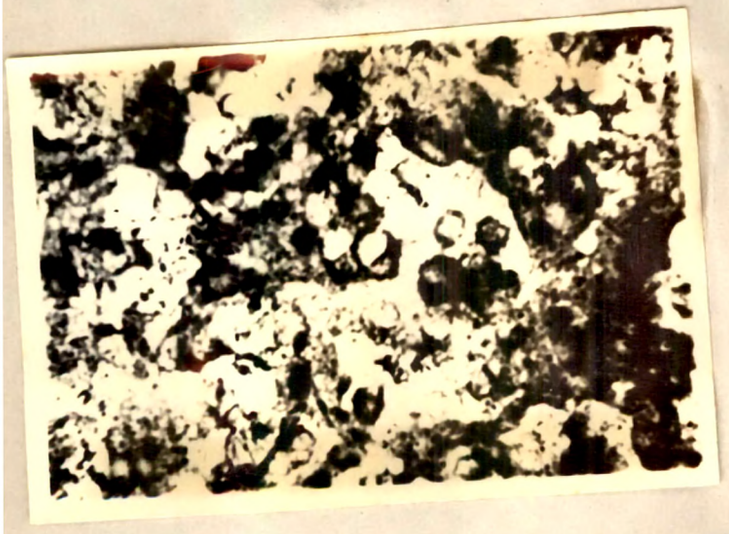


Fig. 14

50 μ

Fig. 15

Figs. 14 & 15. Figs. 12 and 13 magnified.

than in the females. In the thyrotrope cells the Golgi bodies were large and occupied a position close to the nucleus like a cap (Figs. 12 & 14) whereas in the rest of the basophilic cells the Golgi bodies were away from the nucleus and are also bigger in size. The acidophil cells contained small dense Golgi bodies (Figs. 12 & 14). In the last week of April just three or four days before migration, the Golgi bodies in all the cells became bigger and scattered (Figs. 13 & 15) especially much more in the thyrotrope cells. The Golgi bodies in the acidophil cells at this time were also markedly increased in size. The faintly stained Golgi body was seen in the chromophobe cells.

In PAS-methyl blue staining, the Golgi bodies took a pink colour whereas with PFAAB it was stained blue. In the S-cells the same blue colour was present in the cytoplasm. The intensity of PAS-positive and PFAAB-positive staining reaction in the different types of cells as shown by the extent of silver nitrate impregnation a few days prior to migration, increased.

Discussion

The different types of cells in the anterior pituitary were distinguished on the basis of their staining reactions. Cells which stained red or orange with Heidenhain or Crossman's modification of Mallory's stain are termed 'acidophils' while those which stained blue or purple, 'basophils'. In the recent years more staining techniques have been introduced in the study of these cells (Halmi, 1950, 1952; Purves and Griesbach, 1951, 1954, 1955). Staining with Heidenhain aniline blue and PAS of Purves and Griesbach (1951) have been regarded as alternative methods for the demonstration of 'basophils'.

But cases have been reported where unequivocal PAS reactions are demonstrable in acidophils (Ortman, 1956; Purves and Griesbach, 1957; Ortman and Griesbach, 1958). Ortman (1956) has shown that the carmine acidophils stain more with PAS than the Orange G cells. Ortman and Griesbach (1958) have shown that the acid fuchsin (carmine) cells of the wallaby are well stained with aldehyde fuchsin and faintly with PAS. The Orange G acidophils are also stained very faintly with PAS. In the present work the carmine acidophils were deeply stained with acid fuchsin and aldehyde fuchsin while with PAS different grades of intensity of colour was obtained. These results are more or less identical with those obtained by Ortman and Griesbach (1958) in the wallaby. In the cephalic and peripheral regions of the ventral side of the caudal region of pars distalis in the Rosy Pastor, the small Orange G cells were predominent. These cells were negative to acid fuchsin and aldehyde fuchsin stains but positive to PAS reaction. PAS-positive vesicles in the Orange G acidophils have been observed (Pearse, 1949; Pearse and Rinaldini, 1950; Pearse, 1952a) but no functional significance has been attributed to these structures. Ortman (1956) found strong PAS-positive reaction in the azo-carmine acidophilic cells and a weak reaction in the Orange G cells of the anterior pituitary of the frog. In the Rosy Pastor, the small Orange G cells were the smallest acidophilic cells upto the end of March. But later most of these cells increased in activity as denoted by an increase in PAS-positive reaction. The same cells gave a positive reaction with the PFAAB staining and so these have been termed as R-cells

(Adams and Pearse, 1959). These Orange G acidophilic cells at the time of migration, increased in number and more PAS-positive reaction was seen i.e. more R-cells were found. It is quite possible that when there is a great demand of a particular hormone, either the cells should multiply or some other cells should be so transformed as to serve the additional functional requirements.

According to Adams and Swettenham (1958) and Adams and Pearse (1959) the two types of mucoid(basophils) cells are designated as R- and S-cells in the human adenohypophysis by the PFAAB method. Granules rich in the amino acid cystine, are stained blue (PFAAB, Adams and Sloper, 1956). Other granules which contained little cystine are stained red by PAS. The cells stained blue are called S-cells and those stained red, R-cells. Adams and Pearse (1959) believed that R- and S-cells actually overlap with the beta cells (red) and delta cells (blue-purple) of Ezrin et al.,(1958), respectively. In the Rosy Pastor these PAS-positive R-cells were derived from the Orange G acidophil cells and were the mucoid containing acidophils but not the basophils of Adams and Pearse (1959). Owing to the high increase in the number of cells as well as the intensity of staining a few days before migration, the activity of these cells should have a direct relation to the stimulus for migration. In both males and females the same intensity of staining was obtained. Similarly the S-cells in the Rosy Pastor increased in number as well as in the intensity of the staining reaction, towards the time of migration. These cells with respect to their distribution and response to staining with acid fuchsin, may be regarded as acidophil cells. Some of these carmine acidophil

cells took up the same staining as S-cells and contained a large amount of SH- and S-S groups towards the migratory phase.

The acidophils of the anterior pituitary of various species exhibit a strong histochemical reaction for protein bound sulfhydryl (SH) and disulfide (S-S) groups, whereas the basophils and chromophobes contained little or no such material (Ladman and Barrnatt, 1954). The histochemical method for these SH- and S-S groups is specific and has been confirmed by many. The sites of the histochemical reaction are at the same loci as the reaction groups in the protein (Barrnett and Saligman, 1952, 1954). Since most of the protein hormones of the adenohypophysis contained disulfides (Li and Evans, 1948) and the acidophils stain strongly for these groups (Ladman and Barrnett, 1956), these authors concluded that the acidophils contained sulfhydryl and disulfhydryl groups and they are the sites of corticotropin production. Several authors have supported the possibility of the production of ACTH in the acidophils (Finerty et al., 1952; Thompson, 1960). However, some others have suggested that the basophils are the sites of ACTH production (Marshall, 1951; Tuchmann-Duplessis, 1952; Knigge, 1955; Adams and Pearse, 1959). The recent work on the isolated granules from the anterior pituitary showed that ACTH is derived from acidophils (Herlant, 1952a, 1952b, 1953a, 1953b, 1955; Hess and Brown, 1956). Barrnett et al., (1956) employing different techniques such as the use of differential protein solubilities, histochemical staining and bioassay could not definitely establish that the source of ACTH is the acidophil. Nevertheless, they suggested that the acidophils may well be the source. Ladman and Barrnett

(1956) noted that acute stress caused a rapid decrease in the sulfhydryl and disulfide material, but chronic stress (cold) led to an increase. Increase in the corticoids was also observed.

The increase of S- and R-cells in the Rosy Pastor towards the migratory phase shows that there was increased activity of the hormone which should have also acted as one of the factors in the stimulus for migration. The studies on the neurohypophysial system in this bird have shown that there was an increase as well as storage of the neurosecretory material in the pars nervosa (Chapter. 6). From the histological and histochemical studies on the adrenal of the Rosy Pastor it was seen that simultaneously there was tremendous increase of corticoid secretion from the adrenal cortex (Chapter. 10). The increase in corticoid was however, rather slow and gradual towards the migratory phase but three or four days prior to migration there was a sudden increase of corticoids. Correspondingly the same was the increase in the activity of the S-cells in pars distalis which tend to show that the S-cells were responsible for the increase in ACTH which in turn affected the increase in corticoids.

It is difficult to correlate the different changes in the various types of cells of the anterior pituitary with specific physiological activities unsupported by experimental data. Nevertheless, there are some indications of such relationships. The increase in number and extent of granulation of the PAS-purple basophils of Rennels (1957) in the Rosy Pastor during the month of April coincided with the testicular development (Chapter. 5). In the case of females on the other hand there was not any corresponding

increase in the number as well as the intensity in the staining of these cells. So there is hardly any doubt that the activity of these PAS-purple cells is connected with their inherent relationship with gonadial activity probably through FSH in the males as well as females. At the same time the PAS-red cells are very few and do not show much difference in the two sexes during the pre-migratory and migratory phases. Payne (1946) in different stages of development of the chicken hypophysis, found an increase in number and size of basophils during rapid testicular growth, which in females lasted till the laying of the eggs. Breneman (1944, 1945) found an increase of gonadotropic content of the pituitary when the testes increased in weight.

Payne (1944) described a type of cells which he called T-cells having basophilic properties. These cells are possibily concerned with thyroid function. In the Rosy Pastor the aldehyde fuchsin-positive cells resemble the T-cells of Payne (1944). The increase in activity of aldehyde fuchsin-positive cells twice during the period under investigation, could be correlated with the activity of the thyroid (Chapter. 4). The thyroid increased in activity in winter (November to January) reaching the peak in activity towards migration. Similarly the aldehyde fuchsin cells also showed two phases of increased activity one in winter and the other towards migration. A few days prior to migration the aldehyde fuchsin granules were reduced considerably and the cells became chromophobic (Figs, 5 & 6). The degranulation of these cells could be correlated with the release of the thyrotropic hormone in the blood. The observations on the activity of the beta cells (thyrotropes) in

these birds are in confirmity with the functions suggested by Purves and Griesbach (1951) and Halmi (1952) in mammals.

Wolfson (1945) in his studies on the anterior pituitary gland of the Oregon juncos, found seasonal variation in the size of the Golgi body. Side by side with the development of the gonads the Golgi body also increased in size and the same results were obtained in the long day photoperiodically treated birds. He also found two types of Golgi bodies in the anterior pituitary cells but could not identify the cells. In the case of the Rosy Pastor, the increase in size of the Golgi body can be correlated with the increase in the activity of the pituitary cells. The thyrotrope as well as the FSH cells of these birds increased their activity enormously towards the migratory phase and correspondingly the greater increase in size of the Golgi body was observed in these cells. It is well known that the Golgi body plays a role in the secretory activity of gland cells (Junqueira and Hirsch, 1956). The chromophobes are the exhausted cells which lost most of their cytoplasmic granules and the Golgi body in such cells was hardly recognizable.

The small Orange G cells were more numerous during the post migratory and migratory phases. Towards the migratory phase some of these acidophils were converted into R-cells. The remaining Orange G cells towards the migratory phase increased in activity. These cells might be responsible for the production of prolactin or the growth hormone. They correspond to Payne's (1943) small acidophils called 'broody cells'. Schooley and Riddle (1938)

stated that the increase and development of the acidophils in the pigeon coincide with the period of greatest growth and prolactin production. Rahn (1939) also believed that the acidophils produced prolactin and the growth hormone.

Summary

1. A cytological study of the anterior pituitary of the Rosy Pastor during the post migratory and pre-migratory periods revealed that there are six types of cells which could be classified histochemically into three types of basophils eg. the thyrotropes, the FSH and LH secretory gonadotropes and three types of acidophils, the S-cells, R-cells and the small Orange G cells.

2. The thyrotrope cells showed increased activity twice during the period under study. The degranulation of these cells a few days earlier to the migration is correlated with the release of the thyrotropic hormone into the blood.

3. The FSH in the case of males increased enormously in the month of April, side by side with the rapid growth of the testes. In females during the same period the increase was slow. The LH cells were only a few and there were no perceptible changes.

4. The S-cells are derived from the large Orange G cells and are classified as acidophil cells, containing more SH- and S-S groups responsible for ACTH secretion. The increase in the number of these cells a few days prior to migration is correlated with the increase in ACTH secretion and correspondingly the increase in the corticoids of the adrenal.

5. The R-cells originate from the small Orange G cells and show less PAS-positive staining but three or four days prior to

migration these cells increased in number and showed increased PAS-positive staining.

6. The small Orange G cells may be considered responsible for other hormonal secretions such as prolactin and the growth hormone.

7. Changes in the Golgi body in the two sexes were observed and it was also seen that different types of cells contained Golgi bodies of different sizes and shapes. Towards migration the Golgi bodies increased in size and secretory activity.

8. The conversion of the large Orange G cells into thyrotrope cells and S-cells were also observed.