## CONCLUSIONS

For systematic monitoring of water levels in any basin investigations, a main program and 12 subroutines are developed. The subroutines provide individual and integrated water level information at a time over different wells in any basin. A generalized process of evaluation is incorporated and the new design is tested with a field example, establishing the efficacy of the code.

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# ON THE PITUITARY GLAND OF *CHANNA STRIATUS* (BLOCH) WITH RELATION TO GONADAL CYCLE

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### ABSTRACT

The structure of the pituitary gland in *Channa striatus* (Bloch) is studied in detail and its relationship with the breeding cycle is established.

### INTRODUCTION

PISCINE pituitary has been receiving increased attention recently. The pituitary of teleosts undergoes seasonal changes which are correlated with the gonadal cycle. Depending upon seasonal secretary activity, the pituitary presents different histological pictures at different periods. The cyclic changes in the pituitary of *Janynsia lineata* the relationship between the pituitary gland and gonad in *Fundulus*, the epithelial components and their seasonal changes in the pituitary gland of *Cyprinus carpio* and *Carrasius auratus* have all been studied [1-3]. The morphology and seasonal histological changes in the pituitary of *Cirrhinus reba* and the correlative cyclic changes in the pituitary and gonad of *Mystus seenghala* and *Barbus stigma* have been studied by Sathyanesan who also described the pituitary gland of *Ophicephalus punctatus* [4-6].

The histological changes occurring in the pituitary gland of *Salmo gairdnerii* and *Oncorhynchus* and the seasonal variations in the histology of the pituitary gland in *Cirrhinus mrigala* with relation to gonadal activity have also been studied earlier [7-9]

### MATERIALS AND METHODS

For morphological study, the specimens were preserved in 4% formaldehyde solution. The pituitary along with the brain was dissected from the ventral side of the head. The brain length was taken from the end of the olfactory bulb upto the beginning of the first vertebra. For histological details and cellular differentiation, the pituitary along with a portion of the brain was fixed either in Bouin-Hollande sublimate or in Helly's fluid or "Zenker-formal". Serial sections (5-6$\mu$) were stained with (a) Herlant's tetrachrome stain, (b) oxidation-Alcian Blue-PAS-Orange G method and (c) periodic acid Schiff technique.

### OBSERVATIONS

The pituitary gland in *C. striatus* is a small, semicircular structure, slightly elongated anteriorly. It is whitish, soft bodied, lying on the ventral side of the brain behind optic chiasma, lodged in a concavity on the floor of the cranium—the sella turcica. A true stalk is absent and therefore platybasic. The adenohypophysis is divided histologically into three regions: the anterior glandular region or rostral pars distalis; the middle glandular region or proximal pars distalis and the posterior glandular region or pars intermedia. The rostral pars distalis is small and occupies the antero-dorsal portion of the gland. The proximal pars distalis comprises the largest portion of the gland and middle in position. The pars intermedia is large and occupies the posters-ventral position of the gland.

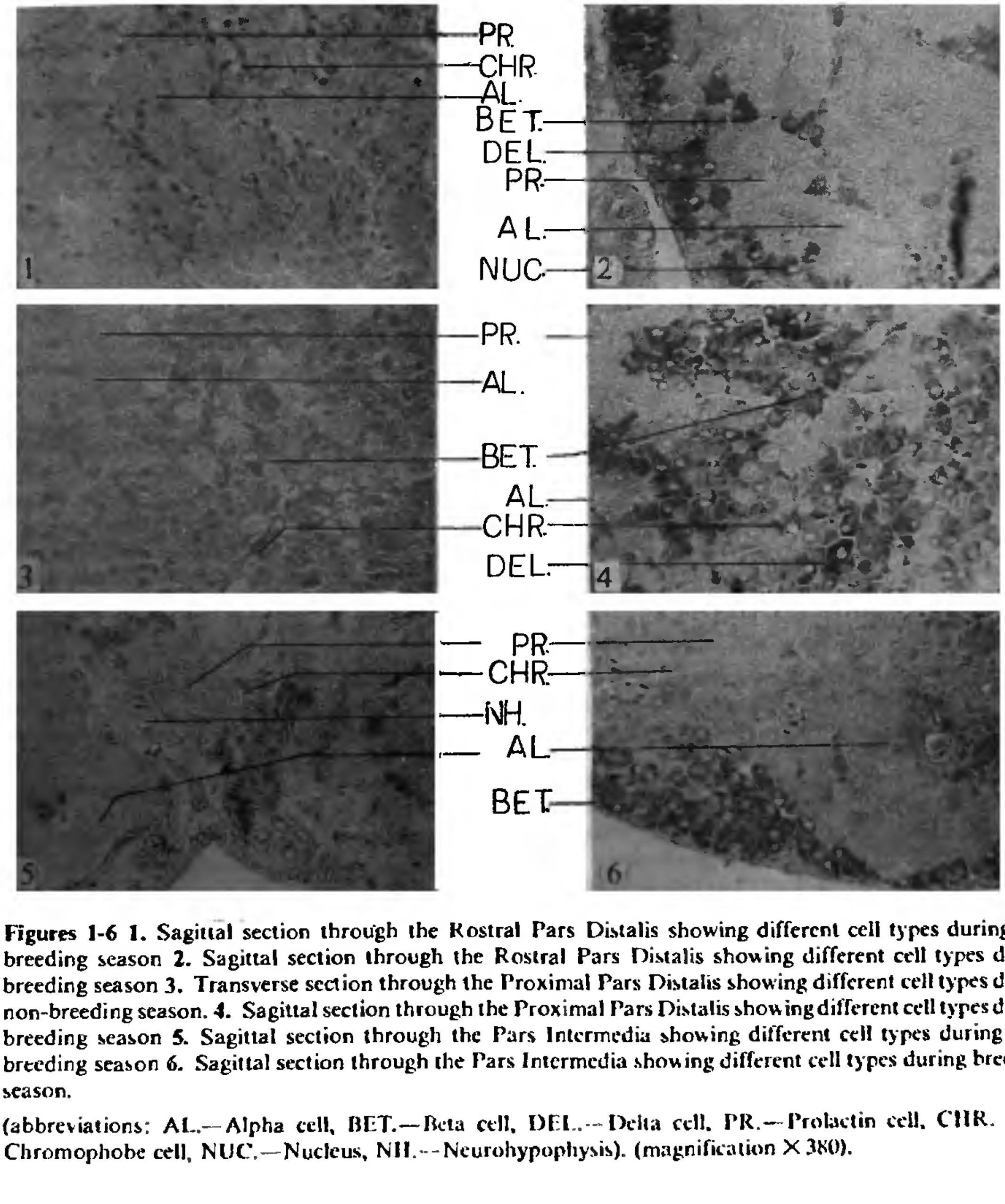
1. General morphohistology:

(a) Brain length and pituitary length relationship: In *C. striatus* the pituitary gland occupies 3.75% (range 3.60% to 3.96%) of the total length of the brain.

(b) Cell types:

The adenohypophysis consists mainly of acidophils, basophils and chromophobes. According to their staining reaction the acidophils are again divided into two types, namely, acidophil I or erythrosinophils or prolactin cells and acidophil II or orangeophils or alpha cells. The basophils are also divided into two types, namely, basophil I or gonadotrophs or beta cells and basophil II or thyrotrophs or delta cells. The delta cells are found to be absent during non-breeding season.

*Prolactin cells*: (figures 1, 3, 5) These cells are usually rounded, oval or elongated in shape and consti-




**Figures 1-6** 1. Sagittal section through the Rostral Pars Distalis showing different cell types during non breeding season 2. Sagittal section through the Rostral Pars Distalis showing different cell types during breeding season 3. Transverse section through the Proximal Pars Distalis showing different cell types during non-breeding season. 4. Sagittal section through the Proximal Pars Distalis showing different cell types during breeding season 5. Sagittal section through the Pars Intermedia showing different cell types during non-breeding season 6. Sagittal section through the Pars Intermedia showing different cell types during breeding season.

(abbreviations: AL.—Alpha cell, BET.—Beta cell, DEL.—Delta cell, PR.—Prolactin cell, CHR. Chromophobe cell, NUC.—Nucleus, NH.—Neurohypophysis). (magnification × 380).

tute about 31.5% of the total cell count. Average diameter of these cells is 8.4 $\mu$m (range 6.87 $\mu$m to 9.62 $\mu$m).

*Alpha cells*: (figures 1, 3, 5) These cells are usually rounded, oval or rectangular in shape and constitute about 42.4% of the total cell count. The average diameter of the cells is 11.7 $\mu$m (range 10.3 $\mu$m to 12.5 $\mu$m).

*Beta cells*: (figure 3) These cells are usually oval, rectangular, elongated or triangular in shape and constitute about 20.07% of the total cell count. The average diameter of these cells are found to be 12.1 $\mu$m (range 11 $\mu$m to 12.4 $\mu$m).

*Chromophobes*: (figures 1, 3, 5) These cells are usually rounded, oval, elongated or triangular in shape, constitute about 6.04% of the total cell count. The average diameter of the cells being 8.8 $\mu$m (range 6.9 $\mu$m to 11 $\mu$m).

(c) Zonations of the pituitary in relation to different cell types:

*Rostral Pars Distalis*: (figure 1) It consists mainly of prolactin and alpha cells. A few chromophobes are also present.

*Proximal Pars Distalis*:(figure 3) It consists mainly of alpha, prolactin and beta cells. A few chromophobes are also found.

*Pars Intermedia*: (figure 5) The pars intermedia is mainly constituted of alpha and prolactin cells. Other than these, a few chromophobes are also present.

II. Morphohistology in breeding season:

(a) Brain length and pituitary length relationship:

During breeding season, in gravid *C. striatus* the pituitary gland occupies 4.07% (range 4.05% to 4.14%) of the total length of the brain.

(b) Cell types:

In addition to the cell types present during non-breeding season, another type of basophilic cell, the thyrotroph or delta cell is found during the breeding season.

*Prolactin cells*: (figures 2, 4, 6) These cells are usually rounded or oval in shape and constitute about 23.9% of the total cell count. The diameter of the cells is 9.08 $\mu$m (average) (range 7.6 $\mu$m to 11$\mu$m)

*Alpha cells*: (figures 2, 4, 6) These cells are rounded, oval or elongated in shape, constitute about 23.65% of the total cell count. The average diameter of the cells is 11 $\mu$m (range 8.9 $\mu$m to 12.4 $\mu$m).

*Beta cells*: (figures 2, 4, 6) These cells are usually oval, elongated or triangular. They constitute about 43.7% of the total cell count. The average diameter of the cells being 18.2 $\mu$m (range 15.8 $\mu$m to 22 $\mu$m).

*Delta cells*: (figures 2, 4) These cells are irregular in shape, may be oval, elongated, triangular, rectangular or pentagonal; constitute about 5.87% of the total cell count. Average diameter of the cells is 12.7 $\mu$m (range 9.6 $\mu$m to 15.1 $\mu$m).

*Chromophobes*: (figures 4, 6) These cells are usually rounded, oval, elongated or triangular, constitute about 3% of the total cell count. The average diameter is 11.55 $\mu$m (range 8.9 $\mu$m to 13.1 $\mu$m).

(c) Zonations of the pituitary in relation to different cell types:

*Rostral Pars Distalis*: (figure 2) It consists mainly of alpha and prolactin cells. Other than these, beta, delta and chromophobe cells are also present.

*Proximal Pars Distalis*: (figure 4) constitute mainly of beta cells. Other than this, alpha, prolactin and very few delta and chromophobe cells are also present.

*Pars Intermedia*: (figure 6) consists mainly of two types of cells, alpha and prolactin. Other than these, a few beta and chromophobe cells are also seen.

## Discussion

The pituitary gland of *C. striatus*, changes significantly, both morphologically and histologically, in relation to the gonadal activity. The size of the pituitary gland increases with the development of gonad. During non-breeding season, on an average, the pituitary occupies 3.8% of the total length of the brain, whereas in a gravid fish, in average, it occupies 4.1% of the total length of the brain. A new type of cells, the delta cells, are found during breeding season (figure 2, 4). The presence of these cells may be related to the gonadal maturity of the fish concerned. The number of prolactin, alpha and chromophobe cells decreases during breeding season, whereas the number of beta cells increases abruptly (more than double). Similarly, though the size of prolactin, alpha and chromophobe cells does not vary much, the average size of beta cells significantly increases during the breeding season. As the beta cells are responsible for gonadotrophin secretion, by increasing both in number and size during the breeding season, it clearly indicates its role in the gonadal activity of the fish.

Sathyanesan[5] opined that in *Mystus seenghala* and *Barbus stigma* some acidophils gradually change into basophils as evidenced by the increased bosophil number during breeding season. In the specimens collected during July, with gonads partly depleted, the chief cell type of the Ubergangsteil is degranulated, the degranulating basophils render this region frothy, the acidophils look like islands in the reticulum, the granulated basophils are rendered chromophobic to stains. In March, when the gonads are in an enlarged condition, the Ubergangsteil is compact and is with granulated basophils. While working on the seasonal variation in the PAS positive cells in the pituitary of

*Mystus vittatus* and *Clarias batrachus*, Singh and Sathyanesan[10] observed that middle glandular region exhibits seasonal variations which are correlated with gonadal cycle. Robertson and Wexler[7-8] observed that the pituitary of trout or of several species of Pecific Salmon with infantile gonads is characterised by the predominance of acidophils, very few basophils and many undifferentiated cells. With the development of gonads, the dorsal lobe increases in relative size, undifferentiated cells disappear and basophils increase until at full sexual maturity, it outnumbers the acidophils. Sahai[11] illustrated curves for both acidophils and basophils in *Ambassis, Puntius* and *Rohtee*, that indicate a clear seasonal change in their size. Moitra and Sarkar[9] observed that in the proximal pars distalis the acidophils predominate during restitution phase of the gonads while the cynophils predominate during breeding season. In the present study also, a direct relationship of the structure of the pituitary with the gonadal cycle *vis-a-vis* the breeding cycle has been established.

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# ANNOUNCEMENT

## SYMPOSIUM ON UNIVERSITY—INDUSTRY INTERACTION

The above Symposium will be held at the Department of Mechanical Engineering Banaras Hindu University, during March 19-20, 1983.

The main objective of this Symposium is to exchange views between the engineers working in various academic institutions and industries of the country. The deliberations of the Symposium are expected to explore factors responsible for the lack of interaction between academic institutions and industries in our country.

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