Anatomical relations of the pituitary.

The pituitary gland, present at the anterior end of saccus vasculosus, is raised above the lobi inferiores, (plate XXIV, fig. 1la), just behind the optic chiasma. Ventrally the gland is enclosed in a depression of the parasphenoid bone. It is covered by a tough membrane on all sides. There is no sella turcica present.

Shape and size of the gland.

The shape of the pituitary gland is oval, raised above the lobi inferiores (plate XXIV, fig. 1lb). In a mature specimen the gland has an anteroposterior length of 2.00 mm. The dorsal surface of the gland is concave,
and the different lobes of the gland are visible externally. The gland is more rounded than in the *Schizothorax esocinus* (Pl. XXIV, fig. 11c).

**Attachment and orientation.**

The gland is attached with the infundibulum through a thick infundibular stalk, which pierces the parasphenoid bone. The attachment is in the mid-dorsal region and the pituitary is therefore of the dorsobasic type. The lobes of the pituitary gland are arranged vertically (Pl. XXIV, fig. 12), and thus it is of the vertical type.

**Extent of the regions.**

Of the three components of the adenohypophysis (Pl. XXIV, fig. 12), the extent of the proadenohypophysis is as a band from anterior to the posterior margins of the mesoadenohypophysis. The mesoadenohypophysis is the largest part and occupies about 2/3 of the entire gland. The metaadenohypophysis is the next largest part of the gland and comprises the postero-ventral part of the gland. The neurohypophysis enters the gland but does not arborize in the mesoadenohypophysis as in *Schizothorax*. It only arborizes in the pro- and metaadenohypophysis, where it extends up to the apex.

**HISTOLOGY.**

**Proadenohypophysis.**

The proadenohypophysis consists of compact acidophils, which are rounded in shape, and are grouped
around the large number of neuro-strands. These are of two sizes, 8 micra and 10 micra, (Pl. XXV, mp. 35). No basophils are seen in this region, but a few Orange-G cells are present in clusters along outer and inner margins. Blood capillaries are common in proadenohypophysis and some secretory droplets are also present. Chromophobes are not distinctly seen.

**Mesoadenohypophysis.**

The main cells comprising this region are acidophils and basophils (Pl. XXVI, mp. 36). The walls and the nuclei of the acidophils are conspicuous. The rounded, centrally placed uniform and distinct nuclei of these cells give a definite distinguishable picture of this region. This characteristic appearance of the mesoadenohypophysis of Oreinus separates it from that of all other fishes studied. The acidophil cells are of two types, 12 micra and 10 micra in size. The cytoplasm of the acidophils is lightly stained.

The basophils are rounded, ovoid, polygonal or irregular in shape, with a light staining circular nucleus each. They are mainly of three types. The first type of basophils (cyanophil type 1) are dark, large globular or irregular cells with the nucleus shifted to one side, while the cytoplasm bulges out on the other side. These are darkly stained with PAS (Pl. XXVII, mp. 38) and are
scattered throughout the mesoadenohypophysis. Their size is 18 to 20 micra and the nuclei are not granular as in case of *Cyprinus carpio*.

The second type of basophils (cyanophil type 2) is 10 to 12 micra in size, and is the predominant type in the antero-central region. They are elongated cells, arranged in strings alongwith the acidophils and have a centrally placed nucleus each. They take a lighter stain than the cyanophil type 1. The third type (cyanophil type 3) consists of small cells which are stained dark red with PAS stain as well as with AF.

The number of blood capillaries is much less in this fish as compared with other Kashmir fishes studied. There are scattered intra- and extra-cellular secretory droplets (stained red with MTS and PAS) present in the mesoadenohypophysis.

**Metaadenohypophysis.**

The metaadenohypophysis receives the main trunk of the neurohypophysis which branches extensively in this region, so much so that it occupies almost half of the area in this region. The metaadenohypophysis consists mainly of acidophil cells, the basophils being absent (Fl. XXVIII, mp. 39; Fl. XXIX, mp. 42).

The acidophils measure 10 to 12 micra, are only of one type, and are rounded with circular clear nuclei. They are uniformly packed usually in strings,
there being no cell clusters, patches or any kind of aggregation of cells as seen in the other fishes studied. It was not possible to differentiate these uniform acidophilic cells with any of the stains (MTS, PAS, AF). Chromophobe cells are discernible here and there but their number is comparatively small. There are scattered amphiphils with the usual large vesicular, centrally placed, darkly stained, globular nuclei, containing a rounded nucleolus each. But as the cytoplasm is clear and non-granular, they look, under the low power, like naked nuclei, since even the cell walls are not distinct. The amphiphils are stained with PAS as well as MTS (Pl. XXX, mp. 43). Blood capillaries are abundant in the metaadenohypophysis, and are surrounded by acidophil cells (Pl. XXVIII, mp. 40).

Neurohypophysis.

The main trunk of the neurohypophysis passes through the middle of the mesoadenohypophysis, without giving any branch to it, and enters the metaadenohypophysis where it arborizes extensively. The portion passing through the mesoadenohypophysis reveals thick linear, arranged fibres, which extend along the main trunk of the neuro-. Large blood sinuses containing red blood corpuscles are also present in the main trunk (Pl. XXXI, mp. 45). The branches of the neuro- are surrounded by acidophil cells (Pl. XXXII, fig. 14). The main stem of the
neuro– is seen to have plenty of neuro–secretion colloid droplets (stained red with PAS as well as MTS), scattered all along its course, becoming sparse in the distal ends of the branches. The neuro– also contains a few large acidophils (probably migrated cells from meta–).

CELL-COUNTS AND SEASONAL CHANGES IN THE PITUITARY

The seasonal gonadial changes in this fish coincide with that of Schizothorax esocinus, but the changes in the pituitary gland are not similar. They are described under the following heads:

1. Resting and immature phase (Aug.–Nov.)
2. Mature phase (Dec.–Mar.)
3. Ripe phase (Apr.–May.)
4. Spent phase (Jun.–Jul.)

Resting and Immature phase.

This period extends from August - November, when the lobes of the pituitary remain indistinct externally. It is during this period that the entire picture of the gland changes histologically. The number of acidophils begin to increase, while the number of basophils also increase in November. The large basophils measure only 10 micra. The outer wall of the acidophils is not distinct in this period, and the number of chromophobes decreases. The blood supply is very poor in this phase. The neuro–strands are very fine and not prominent. The cells of all the regions are small.

A row of large Orange–C cells separates pro-
from meso- and the peripheral cells of meso- are darker. Colloid bodies are rare in the neuro- stalk at this stage.

**Mature phase.**

This extends from December—March. There is not much difference between the pituitary gland of fishes caught in December and in March. There is, however, a gradual increase in the size of pituitary gland lobes.

The number of basophils has increased and is more towards the margins (Pl. XXVII, mp. 38). The basophils are differentiable into three types. The size of type 1 basophils has increased from 14 micra to 20 micra; while the acidophils whose number has also increased (but less that that of basophils), are seen with a distinct outerwall. The basophils are arranged in clusters with well developed nuclei. The cytoplasm of basophil cells of mesoadenohypophysis becomes more granular, stains intensely, and vacuolation starts in some of them. The secretory droplets (both intra- and extra-cellular) are present in large numbers at this stage.

The number of cells in the metaadenohypophysis increases corresponding with the increase in the size of the entire gland. The metaadenohypophysis contains the tree-like branchings of the neurohypophysis which occupies almost half its area (Pl. XXX, mp.44). The percentage of the acidophils has fallen, while that of the basophils has increased during this period. The acidophil and basophil percentages are shown in the graph (Pl. XXXIII, fig.15).
while the cell-counts are seen in histogram
(Pl. XXXIII, fig.16).

Ripe phase.

The fishes are either ready to spawn or are
in spawning condition in this phase. The cleft
between the meso- and metaadenohypophysis has now
become deep. There is a marked increase in the number of
basophil cells of mesoadenohypophysis, which also becomes
larger in size, the largest measuring 20-22 micra.
Large numbers of PAS positive cells are present in the
mesoadenohypophysis at this stage, (Pl. XXVII, mp.38).

The granulation of the basophils reaches its
highest peak in this stage. The degranulated basophils
present in immature and mature phases have disappeared.
There is no vacuolation in these cells.

Acidophils are in small clusters and are less in
number. A number of acidophils are seen in the
ramifications of the neurohypophysis; and it looks as
if they have migrated from the meso- into the main trunk
of the neurohypophysis. The discharged extra-cellular
secretory droplets and cyanophils are often found in
close association with the neurohypophysis. Discharged
secretory droplets as well as some acidophils are also
found in close association with the blood sinuses of the
metaadenohypophysis.

(A specimen caught on 23-5-1967 just after
spawning revealed the following structure. There was increase in the number of degranulated cells and the amphiphils also increased. The secreted material of the basophils (the secretory droplets) have already reached inside the blood sinuses of the meso-. But there is still predominence of granulated basophils over the degranulated basophils.

**Spent phase.**

This phase lasts from June-July. During this phase the process of degranulation of granulated basophils is further continued and the cells become highly vacuolated. The average number of granulated basophils decreases considerably more than in those found in spawning fishes. But the large sized granulated basophils are still in large numbers.

From ending June-August, the basophil cells in the gland become gradually reduced in number. Degranulation of basophils is further continued, indicating the discharge of the secretions. Acidophils also become few in number (Pl. XXX, mp.43, 44).

The number, percentage, diameter, and cell counts of the cells of the pituitary in different months of the year are shown in Table No: 2.
SEASONAL CHANGES IN OVARY CORRELATED WITH PITUITARY

Seasonal changes in the ovary of Oreinus plagiostomus coincide in time with that of Schizothorax esocinus. In the immature fish, which lasts from August-November, a new set of oocytes rapidly grows and the ova become larger, although all the oocytes in the ovary are not in the same stage of development. Correlated with this, the number of acidophils begins to increase, in the pituitary; and the number of basophils also increase in November (Pl. XXIII, fig. 15 & 16).

The ovaries are almost mature in November, and remain in this phase through December-March. The ovaries are compactly large with large ova (Pl. XXXIV, mp. 47). Along with the increase in the ova diameter, the basophil diameter as well as the percentage of the basophils in the pituitary shows some rise during these months.

The basophils are differentiable into three types in March. During April-May, ovaries have increased in size and completely filled up the abdominal cavity. The diameter of the ova is maximum during May; while the diameter of basophils is also highest in this phase (Pl. XXIII, fig. 16).

In the post-spawning period, (June and July), there is a considerable fall in the number and diameter of pituitary basophils and acidophils as also in the diameter of the ova which arise anew.