

**SUMMARY**

**AND**

**CONCLUDING REMARKS**

## S U M M A R Y

The male reproductive system in mammals consists of paired testes, epididymis vas deferens and several accessory glands viz. ampullary glands, seminal vesicles, coagulating glands, prostate, urethral glands, bulbourethral or Cowper's glands and preputial glands. The existing literature on Cowper's glands is briefly reviewed in the introductory chapter. A critical analysis of information available reveals that still there are several avenues open for further researches on Cowper's glands. Except the mammals belonging to the orders Cetacea, Sirenia, Carnivora ( only some mammals such as dog ) it is not known whether these glands are present or absent. In some monotremes the sex-accessories include only Cowper's glands.

The studies on Cowper's glands point out that the glands vary in size, shape, number, cell height, cell types, nature of enzymes, lipids and mucosubstances. The size of the glandular cells in the acini, alveoli or tubules in the Cowper's glands and the amount of secretion exhibit seasonal variations according to the testicular functioning in different phases of the sex cycle ( in seasonal breeders ). With regard to the mucosubstances, some of the investigators have reported diverse results for the Cowper's glands of the same species. Moreover, similarities and also differences exist in the Cowper's gland mucosubstances in closely related species. The effects of castration, castration followed by androgen administration and androgen effects in normal control animals have been studied in limited species of mammals.

The aforementioned points stimulated to undertake the

present investigation on Cowper's glands of six species of mammals and effects of castration and testosterone propionate administration in house rats. Some of the noteworthy observations are described below :

- 1 A single pair of Cowper's are present in all the six species of mammals. They are abdominal in position, lying one on each side of the urethra and open into the lumen of muscular urethra by a duct on each side.
- 2 The shape of the Cowper's glands varies in different mammals such as oval ( bat, he buffalo ), spherical ( white rat ), strip-shaped ( rabbit ), bean shaped ( house rat ) and irregular ( squirrel ).
- 3 The Cowper's glands also vary in size, being smallest in bat ( 1 - 1.5 mm. X 1.0 mm.) and largest in he buffalo ( 4 - 5 cm. X 3.0 cm.).
- 4 The Cowper's glands are multilobulated in the mammals studied except bats.
- 5 The Cowper's glands are acinar type in the bat, rabbit, house rat, white rat and he buffalo and tubulo- acinar in the squirrel.
- 6 The glandular epithelial cells lining the secretory units are cuboidal ( bat, squirrel ), cuboidal to low columnar ( rabbit, house rat, white rat ) and tall columnar ( he buffalo ).
- 7 Two type of glandular cells are present in house rat and buffalo ( referred to them as type-I and type-II cells) based on histochemical results.

- 8 The secretion of the Cowper's glands is stored in a central large cavity before its release in the muscular urethra. A prominent central cavity in each gland is present in bat, house rat, white rat and buffalo.
- 9 The Cowper's gland on each side in the mammals studied is covered by a thin or thick layer of striated muscles. True connective tissue capsule is absent. The connective tissue is prominent between the lobules of the multilobular Cowper's glands.
- 10 The testicular histology reveals that the bats were in the active breeding phase, rabbits and squirrels in the late pre-breeding or early active breeding phase and the buffalos in the post-breeding phase of their sex-cycles. The house rats and white rats are continuous breeders once they attain puberty. Their testes show an intense spermatogenesis, which is restricted to a definite period ( active breeding period) in seasonally breeding animals.
- 11 Atypical mucosubstances are absent in the Cowper's glands of the mammals under present investigation. In this regard sulfated- sialomucins have been demonstrated by some investigators in the Cowper's glands of few bats.
- 12 The histochemical observations indicate a heterogenous distribution of mucosubstances in the Cowper's glands of mammals studied. The glandular cells in the Cowper's glands secrete neutral mucosubstances and glycogen ( bat and squirrel ), neutral mucosubstances and sialomucins (rabbit) and sulfomucins and sialomucins ( white rat). These glands elaborate sulfomucins and sialomucins in type-I cells and

only sialomucins in type-II cells in house rat. On the other hand, type-I cells secrete neutral mucosubstances and sulfomucins and type-II cells neutral mucosubstances and sialomucins in the Cowper's glands of the buffalo.

- 13 The only difference in the Cowper's glands of closely related species is the presence of two type of glandular cells in house rat but single type of cells in white rat.
- 14 Bilateral castration in house rats show atrophy in the Cowper's glands and reduction in size, diameter of acini, height of glandular cells, rate of secretion and amount of secretion in the acinar lumina and central cavity. Such alterations are significant after 10 days.
- 15 Testosterone propionate administration in castrated rats reverse the castration induced alterations in the Cowper's glands.
- 16 Testosterone propionate administration in intact ( control ) rats has no very significant effect on the Cowper's glands except slight increase in size and secretory activity.

#### CONCLUDING REMARKS

Thus the aims and objectives with which the present investigation was undertaken have successfully been fulfilled. The main aims of the present investigation were to find out the presence or absence of Cowper's glands in the animals used, glands if present then their position, size, shape, number, histology, types of glandular cells, nature of mucosubstances secreted by the glandular cells and similarity or differences in these respects in

closely related mammalian species. In addition, the aim was also to establish androgen dependency of Cowper's glands by experiments involving castration and testosterone propionate administration in castrated animals. It is hoped that these aims have been achieved.

The author would like to humbly state that the present is by no means complete. The author had to depend only on histochemical techniques for the identification of mucosubstances and hence trace, poor, weak and moderate quantities of mucosubstances were described in the Cowper's gland cells and secretion of mammals based on the intensities of the stainings. Still there are several avenues open for further researches, some of them are :

- 1 The use of bioassay studies for the estimation of glycogen, sialic acid and sulfomucins in the Cowper's glands.
- 2 Chromatographic separation and identification of sugars like fructose glucose, sorbitol etc. in the Cowper's glands of different mammals.
- 3 To study phylogenetic variations in relation to presence or absence of Cowper's glands, cell types in their secretory units, nature of secretion etc. in large number of mammals belonging to different orders, families and genera.
- 4 Seasonal variations in the Cowper's glands in accordance to the testicular functioning.
- 5 Effects of other androgens, steroid analogs and other chemicals like cis-clomiphene citrate, cyproteroneacetate etc.

The author feels gratified that he has made some preliminary observations. There is unlimited scope for further research

in gonads and sex-accessories of the mammalian males. Some studies are being carried out in this laboratory on the aforementioned aspects, the results of which will be published in due course of time.

" To make an end is to make a beginning  
the end is where we start from."

- T.S.Eliot