FURTHER OBSERVATIONS ON THE STRUCTURE AND FUNCTION OF THE NIDAMENTAL GLANDS OF A FEW ELASMOBRANCHS OF THE MADRAS COAST

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Introduction

The structure and various modifications in the nidamental glands of certain ovo-viviparous and viviparous elasmobranchs have been described in another paper (Prasad, 1945). Studies on similar lines have been continued on four other species of elasmobranchs from the Madras Coast in order to find the variations that occur in the structure of these glands among members having the same mode of breeding and as oviparity gives place to viviparity and to see whether these characters have any relationship to the phylogeny of elasmobranchs. As the main object of this study is not the histology of these glands I have only given the salient features in their structure. Moreover, except for the size and shape of the tubules, cells and nuclei there is no difference between the histology of the glands of these and that of other species already described. Observations as to whether the gland acts as a receptaculum seminis have also been made as before.

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Galeocerdo tigrinus Mull. and Henle

The nidamental glands of *G. tigrinus*, the tiger shark, are two massive structures one on either side of the vertebral column and both these are equally developed. The average size of the nidamental gland is 199 mm. in width and 108 mm. in length whereas the average size of the parent is about 3,775 mm. The central portion of the nidamental gland gives off two twisted diverticula each placed on either side of the cranial oviduct (Text-Fig. 1). The nidamental glands are covered over by a thick vascular mesometrium and have a uniform flesh colour. The central lumen gives off lateral lumina into the horns which follow the course of the horns and in shape they resemble the lumina of the lateral horns of the nidamental glands of *Scoliodon palasorrah*. The inner surface at the anterior albumen

secreting zone shows shallow grooves and ridges and at the posterior region, *i.e.*, the shell secreting zone—lamellæ.

A longitudinal section passing through the different regions of the nidamental gland shows three regions, *viz.*, the anterior long albumen secreting zone of 20 mm., the middle short cranial shell-secreting region measuring 2 mm., and the posterior caudal shell-secreting zone measuring 5 mm. in length. The albumen secreting tubules, opening between the cranial transverse bands, are almost circular in transverse section and are made up of gland cells and ciliated cells. The lamellar region extends up to the caudal shell-secreting region and thus the tubules of both the shell-secreting regions open between lamellæ. These lamellæ are of almost uniform height with broad free ends. The 'tufts' accompanying them are fairly long and pointed in sections. The epithelium covering these is uniformly ciliated.

Spermatozoa were noticed in the posterior shell-secreting tubules of the nidamental glands of two specimens of which in one specimen each uterus contained 20 eggs and in the other the eggs were seen in the cranial oviduct. Three more specimens of the same species were examined and of these one was post-pregnant and the remaining two were immature; none of these had sperms in the nidamental glands.

Myliobatis nieuhofii (BLOCH AND SCHNEIDER)

The nidamental gland of this species is a mere swelling of the oviduct and there is no indication of the lateral horns (Text-Fig. 2). Only one gland is fully developed. As the right ovary and uterus are not well developed the nidamental gland on that side is also not well developed. The external appearance of the nidamental gland shows two well-defined regions, *viz.*, the anterior pink albumen secreting zone and the posterior yellow shell-secreting zone. The inner aspect shows shallow grooves alternating with ridges at the anterior region and lamellæ-like structures at the posterior region. There is a single central lumen.

A longitudinal section of the nidamental gland of this species shows the two zones already mentioned. The albumen-secreting tubules are arranged as in other forms and open in the region of the cranial transverse bands. The albumen-secreting zone is short and measures only 3 mm. in length. The tubules are built essentially on the same model as those of others with gland cells having round nuclei and the ciliated cells having elongated nuclei. In transverse sections the tubules appear to be round and in size they approximate those of the shell-secreting zone.

The shell-secreting zone forms the major portion of the gland measuring 7 mm. in length and is not divided into the cranial and caudal zones. The secretory activity of these tubules is fairly pronounced and the granules of secretion stain blue-black with Heidenhain's iron-hæmatoxylin. The reactions of the different regions to different stains are given in Table I. The

TABLE I

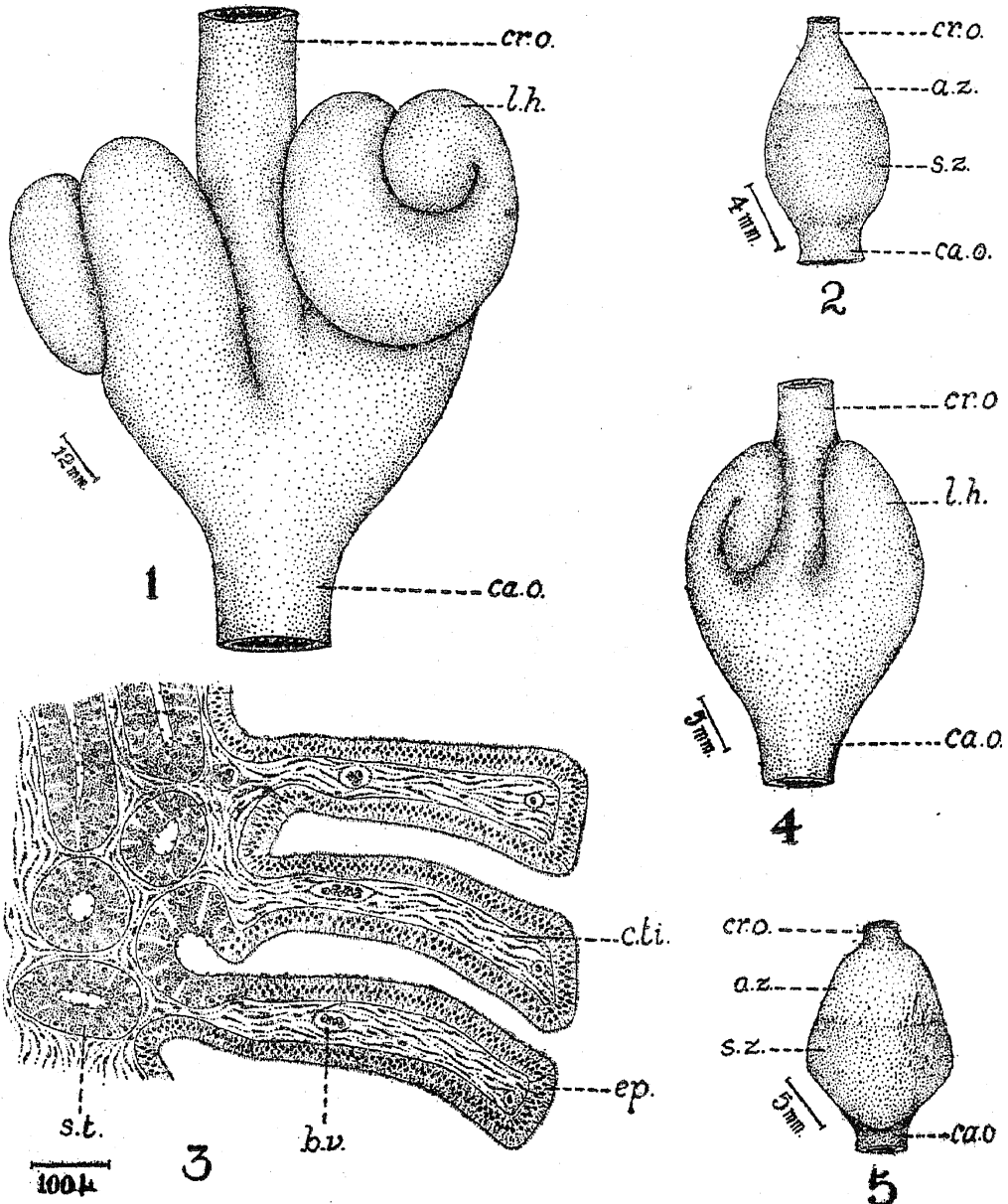
Reaction of the different regions of the nidamenal gland to different stains after fixation in Zenker's fluid

Section of the nidamental gland of	Heidenhain's iron-haematoxylin			Mallory's triple stain			Hoyer's Thionin blue		
	Albumen glands	Shell glands		Albumen glands	Shell glands		Albumen glands	Shell glands	
		Cranial	Caudal		Cranial	Caudal		Cranial	Caudal
G. tigrinus ..	Grey	Black	Blue-black	Light blue with a slight red tint	Bright red	Light red with a blue tint	Light blue	Pale blue	Light blue
M. nieuhofii ..	Pale grey	Blue-black		Light blue	Bright red		Light blue	Pale blue	

tubules open between 'lamellæ' (Text-Fig. 3) totalling about 31. They are of uniform thickness with flat distal ends and are almost of the same height. An interesting feature is noticed in this species. The 'lamellæ' are not accompanied by 'tufts' which are so characteristic of other forms and these are different from the cranial transverse bands only in their size. The epithelium covering these 'lamellæ' is of uniform thickness whereas in other species already studied by me the epithelium of the lamellæ consists of cubical cells having round nuclei at the base and elongated cells with almost oval nuclei at the distal end. In this species the basal cells as well as those at the distal end are of the same thickness; they are similar in being rectangular with oval nuclei and in being uniformly ciliated.

In all pregnant examples of other species examined the uteri showed remnants of egg-cases, however much advanced the stage of pregnancy. But in this species even though the uterus contained embryos measuring 270 mm. (including tail), there was no trace of egg-case in the uterus. It may be pointed out that an examination of even a post-pregnant uterus may often reveal the torn remnants of egg-cases. It has already been stated that in this species the shell-secreting tubules open between mere folds of epithelium devoid of 'tufts'. It is probable that the function of these 'tufts' is to

guard the opening of the tubules and help in moulding the egg-case. Probably the absence of these ' tufts ', which are of importance in the proper



Text-Figs. 1–5.—Fig. 1. The nidamental gland of *G. tigrinus*. Fig. 2. The nidamental gland of *M. nieuhofii*. Fig. 3. Section showing the ' lamellæ ' in the shell secreting region of the nidamental gland of *M. nieuhofii*. Note the absence of ' tufts '. Fig. 4. The nidamental gland of *S. blochii*. Fig. 5. The nidamental gland of *P. micrura*. *a.z.*, Ablumen secreting zone ; *b.v.*, Blood-vessel ; *c.ti.*, Connective tissue ; *ca.o.*, Caudal oviduct ; *cr.o.*, Cranial oviduct ; *ep.*, Epithelium ; *l.h.*, Lateral horn ; *s.t.*, Shell secreting tubule ; *s.z.*, Shell secreting zone.

formation of the egg-case, indicates that no egg-case is formed. It is likely that the shell secretion is poured into the uterus and this along with the albumen may form a sort of nutrient material. In this connection the

observation of Couch (1847) is noteworthy as he has observed the egg-case in an undetermined species of *Myliobatus* and remarks that the egg-case he observed had the surface reticulated.

That probably there is no proper formation of an egg-case may further be confirmed by the simple structure of the 'lamellæ'. This is not only indicated by the absence of the 'tufts' in the 'lamellæ' but also by their uniform height and thickness. It may be mentioned that in the highly developed nidamental glands like those of *Chiloscyllium griseum* the delicate lamellæ show variations in shape, height, etc., between the anterior, middle and posterior ones (Nalini, 1940).

I was able to examine only a single pregnant specimen of this species and hence the conclusion cannot be taken as final. But if it is a fact that no egg-case is formed in this species it forms an interesting example where the nidamental gland is present but no definite egg-case is formed. Thus it will take a place between species like *S. sorrakowah*, where a delicate egg-case is formed, and *Narcine* and *Astrape* in which there are no nidamental glands and no egg-case formation.

Pteroplatea micrura (BLOCH AND SCHNEIDER)

The nidamental glands of this species (Text-Fig. 5) measure 12 mm. in width and 15 mm. in length in a specimen of 809 mm. (including tail). Externally two regions, the anterior flesh coloured albumen-secreting zone and the posterior yellow shell-secreting zone, are distinguishable. There are no lateral horns and a single central lumen is present.

Sphyrna blochii (CUV.)

The nidamental glands of *S. blochii* are well developed, uniformly flesh coloured and measure 22 mm. in length and 20 mm. in width in a specimen of 1525 mm. There are two twisted lateral horns one on each side of the cranial oviduct (Text-Fig. 4) and the central lumen is continued into the lateral horns as the lateral lumina. There is an anterior albumen and a posterior shell-secreting zone. The tubules of the albumen secreting zone open between cranial transverse bands while those of the shell-secreting region open between lamellæ.

SUMMARY

The structure of the nidamental glands of *G. tigrinus*, *M. nieuhofii*, *S. blochii* and *P. micrura* is described.

Spermatozoa have been observed in the shell-secreting tubules of the nidamental gland of *G. tigrinus*.

'Tufts' which are characteristic of the lamellæ of other nidamental glands, are absent in the 'lamellæ' of the shell-secreting region of the nidamental gland of *M. nieuhofii.* No remnant of egg-case is seen in the uterus and it is suggested that owing to the absence of the 'tufts' and the simple structure of the 'lamellæ' probably no egg-case is formed in this species.

References

Couch, J. .. "On the egg-purse and the embryo of a species of *Myliobatus*," *Rept. Brit. Assoc. Adv. Sci.*, 16th Meet., 1847, 80.

Nalini, K. P. .. "Observations on the structure and function of the nidamental gland of *Chiloscyllium griseum* (Mull. & Henle) with a note on the formation of the egg-capsule," *Proc. Ind. Acad. Sci.*, 1940, **12**, 189–214.

Prasad, R. R. .. "The structure, phylogenetic significance and function of the nidamental glands of some elasmobranchs of the Madras Coast," *Proc. Nat. Inst. Sci. India*, 1945 (In press).