X. *On the Male Organs of some of the Cartilaginous Fishes.* By John Davy, *M.D. F.R.S., Assistant Inspector of Army Hospitals.*

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In a paper on the Torpedo, which was published in the Philosophical Transactions for 1834, I have briefly described the male generative organs of this fish as consisting of two firm oval testes, of vasa deferentia without vesiculæ seminales, and of a papilla opening into the cloaca, the common termination of the seminal and urinary passages.

Referring to Dr. Müller's able work, "De glandularum secernentium structura penitiori," in which he treats of the testes of the Rays and Sharks, I find that his descriptions and views of these organs are not in accordance with the above. His words are, "Maxime singularis est genitalium masculorum in Rajis et Squalis conformatio; sunt enim organa glandulosa duplicis generis, altera, quæ hucusque tanquam testiculi descripta sunt, ex globulis, non vero ex ductibus seminalibus conflata, altera, plerumque pro epididymidibus habita, ex canalibus serpentinis composita, sed minime cum testiculis globulosis conjuncta; quare non epididymides sed glandulas proprias esse conjicio*."

He adds, "Organum alterum recte ab Ill. Cuviero jam descriptum est. Dicit enim Cuvierus, 'Ils sont grands, alongés, quoique larges et plats et s'étendent sous l'épine au-dessus du canal intestinal et de l'estomac. Leur plus grande partie est une agglomération de tubercles de la grosseur d'un pois, pressés les uns contre les autres, et présentant chacun un petite enfoncement au milieu de leur face externe. Ils tiennent ensemble par des filaments très-forts, et par la membrane extrèmement délicate, qui les enveloppe, et ne paroissent composés que d'un grand nombre de petits grains ronds très fins. L'autre partie de ces testicules singuliers est formée d'une substance glanduleuse homogène, qui en occupe en arrière, la portion la plus mince, et s'étend sous toute la face inférieure de la portion tuberculeuse†.'"

After alluding to the similar observations of Treviranus on the same organs in the *Squalus acanthias*, and mentioning in confirmation those which he himself had made on the Ray, he comes to the conclusion that the bodies which hitherto in these fishes had been called epididymides, having no connexion with the testes, at least yet discovered, are glands of a peculiar kind; and he conjectures, (stating, however, that it requires confirmation,) that the globular organs are the true testes, and that the spermatic fluid secreted by them, as in the instance of the Petromyzon and the Eel, instead

* Opus cit., p. 105.

† Leçons d'Anat. Comp. tom. v. p. 27.

of flowing through an appropriate canal, may burst into the cavity of the abdomen, and be discharged by the abdominal apertures*.

Such high authority necessarily led me to doubt the correctness of my own observations, and to form the wish to repeat and extend them. This I have been able to accomplish; and I now propose to myself the honour of submitting the results to the Royal Society.

1. *Of the Male Organs of the Torpedo.*

Two good specimens of Torpedo, from the Mediterranean, of middle size, one an Oculata (*T. oculata*), the other a Tremola (*T. diversicolor*), belonging to the Museum of Natural History at Fort Pitt, have enabled me to institute a careful examination of the organs in question of these fishes. The result has accorded perfectly with my first observations made at Malta on the same species in the fresh state.

The testes appeared as I have briefly described them, both in relation to form, situation, and consistence. They exhibited indistinctly the globular structure described by Baron CUVIER in the passage quoted. In neither instance could I discover any traces of the supplementary or attached soft glandular structure noticed by CUVIER. The epididymides [the parts commonly so called] were comparatively large and distinctly tubular, terminating inferiorly in large tortuous vasa deferentia, which proceeded to the papilla or rudimentary penis within the verge of the anus, and superiorly were connected with the testes by a small number of vasa efferentia, applying the term hypothetically.

To this connexion, of course, my attention was particularly directed. The appearances were very satisfactory; small tubes or ducts could be clearly seen, passing from one to the other, and entering into the body of each. They were made perfectly apparent by means of minute dissection under water, and the immersion of the organs in dilute sulphurous acid, which has a property extremely useful in researches on minute structure, of imparting transparency to cellular tissue and serous membranes, and of expanding at the same time tubular and vascular parts.

* The following is the passage at length. "Jam vero nunc evictum credo, epididymidem sic dictam, cujus conjunctionem cum testiculis nemo hactenus vidit, omnes potius supposuere, ne vero glandulam proprii generis esse. Quæritur nunc, utrum organorum testiculus sit, ac, si semen in globuloso testiculo paratur, quomodo semen excernatur. Posset aliquis seminis secretionem in organo altero ex canalibus composito ponere. Sed organon globulosum tam peculiare magnumque est, ut cum alio quopiam organo comparari nequeat. Tum vero meminimus structuram in Anguillis et Petromyzonibus testiculorum globulosam, in quibus semen non per ductum proprium evehitur, sed, uti ova in abdomen defluens, per orificium simplex excernitur. Quæro num etiam in Rajis et Squalis semen ex globulis in cavum abdominis propullulet et orificiis illis evehatur, quæ tam in masculis quam feminis Squalis et Rajis obveniunt? licet in feminis ova proprio duplici oviductu evehantur. Hoc observationes ulteriores evincere debent. Incertum etiam manet, cujus naturæ sit secretio alterius permagnæ glandulæ, utrum maximum momentum in hocce potius organo positum sit, an glandula testiculis succenturiata sit. Certe liquor glandulæ copiosissimus alius longe naturæ est ac testiculorum globulosorum et a glandula illa ipsa secernitur." He adds, "Itaque vera epididymis in piscibus non adest."—Op. cit. p. 107.

2. *Of the Male Organs of the Thornback (Raia clavata).*

On the 12th of October I had an opportunity, under very favourable circumstances, of examining a male Thornback, of large size, shortly after being caught. This being the breeding season of this Ray, its generative organs were fully developed, and every part of them was peculiarly distinct and large,—as the globular organs, considered by Professor MÜLLER as testes; their soft milt-like appendage, attached to their inferior extremity, and partially bordering their inner margin; the massive epididymides, conjectured by Professor MÜLLER to be glands of a peculiar kind; and the vasa deferentia, tortuous, of capacious dimensions, terminating in a kind of urethra, close to the necks of the two sacs, which I believe perform the double function of urinary bladders and of vesiculæ seminales.

The structure of the milt-like appendages, of the globular testes, and of the epididymides, was in accordance with Baron CUVIER's and Professor MÜLLER's description of them. In neither of the two former could I observe any appearance of tubular structure, which was very strongly marked in the last.

As in the instance of the Torpedo, I made careful search after a connexion between the testes and epididymides; and using nearly the same means, I was able to satisfy myself that such a connexion exists, and in the same situation, namely, between the superior extremities of the two parts, where the space separating them is inconsiderable. The tubes of connexion, however, were smaller, and more difficult of demonstration than the analogous ones of the Torpedo.

As the vasa deferentia were distended with a cream-like fluid, which had very much the appearance of the spermatic fluid, it appeared probable that some satisfactory evidence might be obtained by instituting an examination of the contents of the different parts; and that it would be best effected by means of the microscope. The instrument I used was one of Mr. Ross's construction, provided with an achromatic object glass of one-eighth of an inch focal distance.

First, the fluid contained in the sacs, which I suppose to perform the double function of urinary bladders and of vesiculæ seminales, was submitted to examination. It was of the appearance and nearly of the consistence of cream. Under the microscope it was found to abound in animalcules in active motion, mixed with globules of different sizes. They were best seen when the fluid was diluted with a solution of common salt. The animalcules were proportionally of great length, not unlike portions of fine hair; one extremity was of extreme fineness, and seen with difficulty. Their motion was serpentine and vibratory, and of great velocity when most active, especially that of the tapering part; and their progressive motion was unquestionable, the effect of their own powers, independent of currents.

Next, the fluid from the vas deferens was examined, taken from its commencement, just after leaving the body of the epididymis. Its appearance to the naked eye, and its character under the microscope, were very similar to those of the preceding. It

abounded in the same animalcules, also in active motion, many of them grouped together in bundles, and which so joined side by side acted together, the tapering part, in which the approximation was greatest, moving with great velocity in a vibratory manner.

Lastly, I examined the fluid yielded by the globular testis, procured by making an incision into its substance, and gently scraping the cut surface. The small quantity of fluid thus obtained was opaque, but not so thick as the last. Under the microscope it was found to contain animalcules similar to the preceding, and in motion, but less numerous, and not grouped, intermixed with small globular masses of an obscure granular and radiated structure.

3. *Of the Male Organs of the common Skate (Raia batis).*

On the 8th of November, under the same favourable circumstances as the preceding, I examined a male fish of the above species, in which the generative organs were fully developed, and as far as I could observe generally, were in no respects essentially different from those of the Thornback.

In this instance, for the sake of as much accuracy as possible, I began with an inspection of the fluids likely to throw light on the functions of the generative organs.

The fluid first subjected to the microscope was some contained in the cavity of the abdomen, transparent, with a small opaque sediment. It was found to contain globules of different sizes, the largest less than common pus-globules, and a few elliptical blood particles, without any animalcules.

The fluid next collected was that contained in the urinary bladders. It was nearly colourless and limpid. Under the microscope many small globules were visible in it, about one half the size of pus-globules, and a few animalcules, resembling those of the Thornback, and yet not precisely similar.

On pressing the vasa deferentia, where they pass on the inner side of each urinary bladder, a cream-like fluid was discharged into the cloaca through the papilla, the termination of the urinary, and, as I believe, seminal ducts. This fluid under the microscope was found to abound in animalcules, mixed with a few globules, both similar to those last mentioned; the former in active motion.

Next, the vas deferens was opened into before it passes behind the urinary bladder, and some fluid was obtained from it, not inconsiderable in quantity, and of the colour nearly and consistence of cream. Under the microscope it was found to abound in animalcules of a thread-like form, having one extremity excessively fine, very active in movement; their motion vibratory, as well as progressive; in every respect closely resembling those of the Thornback; and like them, owing to their vast number and being intermixed with many globules, to be seen distinctly the fluid required to be diluted.

The globular testis was next cut into; a portion of it was removed by a horizontal incision. It abounded in fluid, more liquid than that of the vas deferens, and less

opaque. Under the microscope many animalcules were seen in it, precisely similar to those of the vas deferens, but not in motion, as if dead; and mixed with them were many globules of different sizes, the largest about the size of pus-globules, a few blood corpuscles, and some fragments of irregular form.

Lastly, an incision was made into the lower non-globular milt-like part, bordering the globular testis. It abounded in thick opaque fluid, of which a sufficient quantity was collected for examination by gentle pressure. Under the microscope it was found to contain a large number of globules of about the size and general appearance of pus globules, a few very much smaller, and a few animalcules, less distinctly formed than those in the globular portion and in the vas deferens, but clearly of the like kind.

The anatomical examination of the organs was next entered on. I have stated that at first view they appeared generally not to differ from those of the Thornback; a minute inspection confirmed this. A tubular connexion was found between the head of each testis and epididymis, not admitting of doubt; the tubuli were traced from the globular substance into the mass of the epididymis.

On the 24th of November another fish of this species was procured, in which also the male organs were in a very favourable state for examination, and which were examined with great care, having in view the doubtful points. No fluid in this instance was contained in the abdominal cavity; not a single drop could be collected.

As the globular and the milt-like testes, both of this Ray and of the Thornback, are connected with the epididymides by a delicate peritoneal covering, leaving a cavity on each side of the spine between the testis and epididymis, which descends close to the bladder, it occurred to me as possible, although not probable, that this cavity might be a channel between the respective testes and the cloaca. To endeavour to determine this, a small opening was made into the cavity, and it was forcibly distended with air by means of the blow-pipe, but no orifice inferiorly could be detected; the air was completely confined.

This done, the fluid contents of the different parts were subjected to microscopical examination in the following order; first, that of the urinary bladders; secondly, that of the milt-like testis; thirdly, that of the globular testis; and lastly, that of the vas deferens. The results in part were somewhat different. The fluid contained in the two urinary bladders amounted to four-fifths of a cubic inch; like the former it was colourless and transparent, with a very slight sediment. It contained a few globules, but no animalcules. The milt-like part of the testis yielded but little fluid; a minute quantity of it, collected by scraping gently an incised surface, exhibited under the microscope no animalcules, but many well-defined globular particles of different sizes, commonly smaller than pus-globules, and a few blood-corpuscles. The globular portion of the testis abounded in fluid of a creamy appearance, containing many animalcules mixed with globular particles; the former precisely similar to those observed in the first instance, and like them motionless. The fluid of the vasa deferentia, which flowed out on opening into them, amounted to seven-tenths of a cubic

inch. It had the same character as that procured from those canals in the other specimen, and abounded in animalcules in every respect similar, and like them in active motion.

The anatomical examination, too, in this instance afforded a result precisely similar to the preceding; a connexion by means of tubuli was discovered between the head of each testis and epididymis, and nowhere else, after very careful search. The whole of the generative organs, with the urinary associated with them, were removed entire, and were immediately examined under spirit of wine.

4. *Of the Male Organs of Scyllium Edwardii.*

This is the only species of Shark, the male organs of which recently I have had an opportunity of examining; it was brought by Dr. Andrew Smith from the Cape of Good Hope; and to this gentleman I am indebted for permission to inspect it. The parts were not in the best condition; they had suffered from keeping, especially the testes. The epididymides were large; as were also the vasa deferentia, which terminated, as in the foregoing instances of the rays, in a kind of urethra, connecting the urinary bladders with the cloaca.

Having found that the spermatic animalcules of the Mammalia are but little liable to change, that they may be detected even in putrescent fluids, and may be kept for a long time in spirit of wine, I thought it worth while to examine with the microscope any fluid that might be found in the vasa deferentia of this Scyllium. A little turbid fluid mixed with grumous matter was procured by laying them open, in which, when diluted, animalcules were distinctly seen, resembling much those of the Rays.

This result induced me to try the contents of the testes and vasa deferentia of the Torpedo. The experiment was made with two fishes, varieties of the Tremola, rather below the middle size, which I had sent home from Malta, now more than four years ago preserved in spirits. The vasa deferentia of both were large; and when opened afforded pretty much opaque, white, semifluid matter. When diluted with water and placed under the microscope, animalcules were distinctly visible in it; thread-like, serpentine, finely tapering towards one extremity, very similar to those of the common Ray and Thornback, but decidedly smaller; and animalcules of precisely the same kind, but less numerous, were detected in the semifluid opaque matter obtained in minute quantity by scraping gently the cut surface of the testes. The animalcules in the testes and vasa deferentia of both specimens offered no perceptible difference.

5. *Of the Accessory Male Organs.*

Before entering on the inferences to be drawn from the foregoing observations relative to the functions of the different parts constituting the male organs which are contained within the abdominal cavity, I would wish to offer a few remarks on the external accessory organs, which have commonly been considered auxiliary to the more important internal ones.

They are the anal appendages, the characteristic of the male cartilaginous fishes, organs of complicated and curious structure, the use of which even at present is far from being understood.

The Torpedo, the common Ray, and the Thornback are the only species of Rays which I have yet carefully examined in relation to the organization of these parts. In each species they are very similar, consisting of articulated bones, muscles, mucous glands, mucous ducts, &c., and containing a large and remarkable gland associated with an elaborate and complicated structure. On account of the large size of the common Ray and its large anal appendages, and their full development, the gland and its accompaniments are seen in this fish to great advantage. In two specimens of *Raia batis* which I have examined, the gland was nearly the size of a chestnut, of a very elongated oval form, divided on one side, as it were, into two columns by a furrow or depression, in which were two rows of delicate projecting tubuli, the extremities of its excretory ducts. The substance of the gland was enveloped in a muscular coat, and this was covered with a vascular tissue. The gland itself was contained in a sac composed of three coats, an inner fibrous coat, a middle muscular, and an outer cellular one; and was surrounded with strong muscles, the principal flexor and extensor muscles of the organ*.

Moreover, at the inferior extremity of the sac, just below its outlet, there was a distinct cavity, formed of muscular walls and intersected by delicate tendinous fibres. In one instance, when under examination, the fish was still irritable, its muscles acting when stimulated, and then this part pulsated regularly and vigorously. It contained blood: I believe it to be an auxiliary heart, designed for circulating the blood in the appended organ. A similar structure exists in the same situation in the Thornback and Torpedo.

In the sac of the gland a cream-like secretion was found, and the same flowed out pretty copiously through the excretory ducts when pressure was applied to the gland. It was neither acid nor alkaline; it was slightly viscid; applied to the tongue no sensation was immediately produced, perhaps there was an after one approaching to acrid, but so slight as to be doubtful. Under the microscope it was found to abound in very minute, dense, spherical particles, twenty of which, at least, would be required to form a mass equal to a blood corpuscle of man. They had no appearance of independent vitality, and moved only when in currents.

The blood in the pulsating cavity, from which it is probable that the secretion just mentioned is formed, coagulated like ordinary blood on exposure to the air; but it was more dilute; and, what is remarkable, under the microscope its particles appeared to be smaller, and the majority of them not elliptical but globular.

* Bloch in his description of these organs describes only two muscles; but there are more, some connecting the organ with the pelvis, others attached to the principal bones, and others to the smaller bones; which is, as might be expected, considering that eleven bones and one terminal cartilage enter into the composition of each organ. This number I found in the instance of the Thornback; Bloch states, that in this fish they are eight (Hist. Nat. des Poissons, iii. 672.).

How the anal appendages are constituted in Sharks I cannot speak from my own observations, having yet examined these organs only in one instance, that of *Scyllium Edwardii*, before referred to. From the descriptions of naturalists it may be inferred, that they vary more or less in organization in different genera; that in some, as probably in the genus Carcharias, there is a distinct gland, secreting an opaque fluid, similar to that of the Rays I have mentioned; but in others, as in the genus Scyllium, the gland is wanting, and its place is supplied by a sac, one for each organ, situated under the common integument of the lower part of the abdomen, communicating by a narrow elongated passage with the appendage*, and containing a slightly viscid fluid†, probably secreted by follicles situated between the fibrous inner coat and its outer muscular one. This structure I am informed by Dr. Andrew Smith, who it would appear first observed it, occurs in every species of the genus; and, as in one specimen, that of *Scyllium Edwardii*, the gland is not to be found (we carefully sought for it together), it is probably deficient in the others.

6. *Concluding Remarks.*

As in the Torpedo, the common Ray, and the Thornback, a tubular communication has been found to exist between the globular testes, and the bodies hitherto called epididymides; as the fluid in the former was found to be similar to that of those canals, continuations of the epididymides, which have commonly been considered as vasa deferentia; as this fluid, in its entozoa, possesses the essential character of a spermatic fluid; and, lastly, as it could not be detected free in the cavity of the abdomen, may it not be inferred, and is not the conclusion unavoidable, that the old opinion respecting the functions of these different parts is correct, and in accordance with the names which they have received?

The evidence on which this conclusion is founded is manifestly of two kinds; one anatomical, the other microscopical, connected with the constitution of the spermatic fluid. Preparations have been made of the parts showing the tubular connexion, which are deposited in the collection of comparative anatomy belonging to the museum at Fort Pitt.

Relative to the evidence derived from the nature of the spermatic fluid, I apprehend, now, it will generally be admitted as satisfactory. I have examined the spermatic fluid of many species of Mammalia, and the animalcules contained in it were in no instance more distinct than those of these fish; indeed in the latter they were perfectly so, and their character well marked. They were immediately killed by spirit of wine; they were torpid and motionless in a saturated solution of common salt; they became active when the solution was diluted; and in the unmixed fluid they

* It communicates with the outer surface of the appendage by an opening close to the anal membrane, and also with the groove or tube of the organ, and thus with its internal surface. The one opening is not continuous with the other as in the Rays, a space equal to about a quarter of an inch intervenes.

† According to Dr. Smith, the fluid contents are like very dilute white of egg.

retained life for three or four days after removal from the fish, until signs appeared of incipient putrefaction.

It is true that Sir EVERARD HOME, in the fifth volume of his Lectures on Comparative Anatomy, has denied that spermatic animalcules essentially belong to the prolific fluid, and was of opinion that they are a mere fiction of the mind, because neither he nor Mr. BAUER could detect them. His opinion at the present time, I apprehend, can have no weight, and it will be received only as a proof of the imperfection and feebleness of the instrument which he used, and serve as a warning, much as it is to be regretted, that no reliance is to be placed on his microscopical observations.

The testes of the Torpedo are distinguished from those of the Thornback and common Ray, by wanting that milt-like margin or appendage described by Baron CUVIER. Should it be found wanting in all the viviparous species of cartilaginous fishes, its presence in the oviparous may be considered as a link between them and the osseous oviparous fishes furnished with milts*. Perhaps in the milt-like part of the testes of the Ray and Thornback, the ova of the spermatic animalcules are developed; and, perhaps, in the globular portion they grow and are matured. The microscopical observations described seem to be rather in favour of this idea.

If the view which I have advocated of the functions of the testes and of the epididymides be received, the structure of the subordinate generative parts within the cavity of the abdomen, will, I believe, be found to be in perfect accordance, and to offer fresh evidence in favour of its correctness: I now allude to the vasa deferentia and the part or parts inferiorly connected with them.

The vasa deferentia in the three Rays which have been noticed are similar, and well adapted both to conduct and to hold in reserve such a fluid as the spermatic, for they are comparatively large and tortuous, and are provided with circular valvulæ conniventes, forming a vast number of cells. Both in the Ray and Thornback, and in the Torpedo, they terminate in what may be considered the urethra of a rudimentary penis, the end of which projects into the cloaca in the form of a papilla. In the Torpedo, which differs from the other two in having no urinary bladder, the spermatic and urinary ducts terminate near the mouth of the papilla, by separate and very minute orifices. In the Thornback and Ray, which are possessed of two urinary blad-

* The spermatic fluid of the milt of the bony fishes bears some resemblance to the fluid of the milt-like portion of the testes of the Rays. I have examined it in the Herring, Smelt, Cod, Dab, and Pike; in the three first it appeared minutely globular, and no filamentous prolongations were distinctly visible in the animalcules; in the Pike a single filament was seen attached to many of the globules, and in the Dab, two. MM. DUMAS and PREVOST state that the spermatic animalcules of all the fishes they had examined are filamentous, and that the filament or prolongation had previously escaped observation on account of its great tenuity; an opinion I can readily adopt, as I could perceive the prolongations of the animalcules of the Dab and Pike only in a very favourable light, and by means of very nice adjustment. What the species of fishes were examined by these gentlemen is not noticed; their remark on the subject is made incidentally in their ingenious memoir on the spermatic animalcules of many of the vertebrata, with the promise to give the details on a future occasion (Ann. des Scien. Nat. tom. i. and ii.).

ders, these ducts terminate near the fundus of the short urethra, and close to the neck of each bladder, or its opening into the common passage*. These bladders appear to be somewhat analogous to the bifid bladder of Frogs and Toads, the latter connecting them with the simple urinary receptacle of the higher vertebrata.

I have expressed the opinion that these organs may perform the double function of vesiculæ seminales and of urinary bladders, partly from their situation and connexion, and partly from their contents. I have mentioned, that in one instance, I found in them some spermatic animalcules, which may be considered equivalent to spermatic fluid. The result of a chemical examination of one specimen of the fluid which was contained in them, amounting nearly to a cubic inch, was favourable to its urinary character; for besides affording a little saline matter, principally common salt, it yielded a little animal matter very analogous to urea, soluble in alcohol, uniting with nitric acid, and the compound crystallizable and soluble.

The nature of the anal appendages and their functions, have from the earliest times of natural history been more or less a subject of controversy. Aristotle considered them as characteristic of, and peculiar to, the male cartilaginous fishes. Lorenzini erroneously denied that they are distinctive marks of the sexes. Willoughby, Ray, Artedi and Broussonet considered them as organs of intromission, as penes. Rondellet opposed this notion, and considered them as holders, in which opinion he was followed by Bloch, who, I believe, was the first to describe them with tolerable accuracy and minuteness†. Recently, some naturalists appear to have adopted one conclusion, some the other. The majority favour the idea of Bloch, that they are analogous, as he ingeniously endeavoured to prove, to arms or rather feet, and intended for seizure and holding fast. A small number, amongst whom M. de Blainville is eminent, seem to have returned to the older notion that they are penes. Bloch's argument against their being penes, is founded on their structure, in his opinion totally unfit for their supposed office. Those who maintain the opinion he opposes, lay stress on the appearance of the fluid secreted by the gland belonging to each appendage, so much resembling the spermatic fluid, and on the analogy in certain of the reptiles of a double oviduct and double penis.

Objections, it appears to me, are unavoidable to both these views. As regards the latter, it is highly improbable that there should be two sources of spermatic fluid: moreover, it has appeared that the fluid of the appendages is without the characteristic quality of the spermatic fluid, containing no entozoa, and seeming to be of a peculiar kind. As regards Bloch's view, it seems improbable, were the appendages de-

* Delicate probes passed through the bladder, ureter, and vas deferens of the common Ray and Thornback meet at the bottom of the short urethra, common to both sides; the openings into it are small and contracted; the vas deferens on each side terminates in it by a projecting papilla, having an oblique direction. I have carefully sought for a termination of these ducts into the bladder itself, but in vain. I mention this particularly, because a passage in the valuable Descriptive Catalogue of the Museum of the Royal College of Surgeons would seem to imply such a termination (vol. iv. p. 51. No. 2394.).

† Hist. Nat. des Poissons, iii. p. 672. His description was confined to these organs in the Thornback.

signed for prehension, that they would be furnished with a gland copiously secreting a lubricating fluid: nor does their general structure or situation appear to be apposite for the purpose he imagines, especially as he is of opinion that the rudimentary penis is applied in the act of impregnating to the surface of the cloaca, where the mouth of the oviducts or uterine cavities open.

Reflecting on the subject and on the inadequacy of former hypotheses, it has occurred to me as possible, that these organs may be designed for intromission and retention like the penis of the Dog. On this idea, the abundant secretion of the gland, as a lubricating fluid, would be of manifest use, and the action of the different parts might admit of explanation. And, as the sacs connected with the appendages in certain of the Sharks open appropriately, they may be supposed to be designed for the same use*. In venturing to bring forward this conjecture, I beg to be understood, that I attach no kind of importance to it. I am fully aware that it is liable to objections. I shall be satisfied should it lead to further inquiry, by which alone the true use of these mysterious organs can be determined.

* After writing the above, on referring to ARISTOTLE, that great and curious storehouse of natural history, I found that a similar idea had been entertained in his time, and that there were some who declared they had witnessed the fact. "Sunt qui se vidisse confirment nonnulla ex cartilagineis aversa modo canum terrestrium cohærere." De Hist. Animal. L. v. c. v.

Fort Pitt, Chatham,
Dec. 22, 1838.