On the male generative organs of Hyaena crocuta / by M. Watson.

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ANOMALURUS FULGENS.

ON THE MALE GENERATIVE ORGANS OF *HYÆNA CROCUTA*.

BY

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(Plates XXIV. & XXV.)

In a previous communication [1] I laid before this Society a description of the female organs of *Hyæna crocuta*, and having lately had an opportunity of examining those of an adult male of the same species, have thought that a description of these would not be altogether uninteresting, more especially as, so far as I can ascertain, no complete account of them has hitherto been published. For the sake of comparison I shall follow the plan pursued in the paper referred to, describing in the first place the external, and secondly the internal organs of generation.

External Parts.

The anal and perineal regions of the male resemble so closely those of the female that without a very accurate examination it is impossible to distinguish between the sexes. In both there is a well-marked glandular pouch above the anus; in both there are cutaneous elevations corresponding in appearance to that of the scrotum in the males of allied species; and in both there is an elongated, pendulous, penis-like body, surrounded by a prepuce, and perforated at its extremity by a single aperture of small size.

Penis.—This organ is directed forwards, and lies along the middle line of the perineum as in the dog. The free portion, consisting of a central glans surrounded by a thick fleshy prepuce, projects forward and downward from the level of the abdominal wall, and measures one inch and a half in length. The glans is conical in form and without distinct corona, the urethral aperture being situated on the apex of the cone. The inferior lip of this aperture is prolonged forward to some extent, so that seen from the side the glans presents the appearance of being obliquely truncated from before backward and upward as in the female, although the truncation is not so well marked as in that sex. In the flaccid condition of the organ the glans is for the most part concealed by the prepuce, its apex only being exposed. The latter portion is of a dark blue colour, and its surface is much corrugated, whilst so much of the glans as is concealed by the prepuce is of a purplish colour and presents no trace of corrugation. Its basal two thirds are moreover covered by small

[1] Proc. Zool. Soc. May, 1877.

recurved spines, which diminish in size toward the margin of the prepuce and are altogether absent on its free corrugated portion. The urethral aperture is smaller and less dilatable than the corresponding opening in the female. The prepuce, consisting of a thick double fold of integument of a bluish colour externally and flesh-coloured internally, is thrown into well-marked circular rugæ and is attached by a distinct frænum to the under surface of the base of the glans. When retracted it is continuous with the surface of the latter. In the female the frænum is attached, not to the *base* of the glans, but to the inferior lip of the urino-genital canal.

Perineum.—The perineum, from the inferior border of the scrotum to the base of the free portion of the penis, measures 4 inches in length, a measurement which agrees exactly with that of the corresponding region of the female. The integument, like that of the prepuce is of a bluish colour, smooth, and devoid of hair with the exception of a space immediately behind the free portion of the penis, which space is covered with down of a light yellowish colour, the hairs being directed forwards. It is worthy of note that this area in the male corresponds exactly with that which in the female is studded with the little depressions described in my paper on the genital organs of that sex. And here I would take the opportunity of correcting an error into which I unwittingly fell in that paper. I refer to the statement contained therein that the integument of the female perineum is thrown into longitudinal rugæ. These, as the accompanying drawing shows, are altogether absent in the male in the recent state of the parts, and only manifest themselves subsequent to their immersion in alcohol. As the female organs had been subjected to this treatment previous to their examination, I have little doubt that in their natural condition these parts present the uniformly smooth appearance I have just described in the male animal. The presence of these folds in the female, moreover, induced me to hazard the conjecture that they *might* represent in *H. crocuta* the labia of other carnivora. This supposition is now no longer tenable, as the examination of the male perineum has led me to conclude that the homologues of the labia are not to be sought in the longitudinal perineal folds just referred to, but rather in the cutaneous elevations described in my former paper under the name of "scrotal pouches."

Scrotum.—The scrotum is non-pendulous, and resembles that of the Felidæ proper. It is situated one inch below the margin of the anus; and its division into two is indicated externally by a shallow groove. Each half is about the size of a small walnut; and the surface of each is covered with hair of a light brown colour. It is interesting to observe that this description corresponds almost exactly with that of the so-called "scrotal pouches" of the other sex, the only difference being that in the male the scrotum is slightly more prominent than the "scrotal pouches" of the female.

Anus and Anal-gland Pouch.—The anus is situated one inch above the scrotum; and between the former and the root of the tail is a pouch similar to that which is found in the female. The interior of the pouch is smooth and devoid of hair, except the roof, which is

clothed with down of a lightish colour. The down at the external angles of the pouch is longer than elsewhere, and forms two tufts which project into the pouch. Opening into the bottom of each extremity of this pouch is the duct of an anal gland; whilst extending between these larger apertures is a belt of small perforations, which indicate the ducts of a number of small isolated follicles lying in relation to the fundus of the pouch.

Nipple.—Upon either side of the middle line, and half an inch external to the free portion of the penis, is a single rudimentary nipple. It measures one eighth of an inch in height, and lies concealed in the thick hair of this region.

Internal Organs.

Rectum and Anal Glands.—The rectum occupies the usual position in the pelvis, and is provided with walls of unusual thickness, the external or longitudinal muscular bundles being particularly well developed. It is attached to the lower surface of the sacrum by a double fold of peritoneum or meso-rectum, which measures between two and three inches in breadth, and consequently allows of considerable movement of the rectum within the cavity of the pelvis. The terminal portion of the rectum is surrounded by two muscles, the levator and sphincter ani. 1. The *levator ani* is of considerable strength, and arises from the fascia lining the pelvis. Its fibres pass backward and upward, and terminate on the walls of the rectum under cover of the sphincter ani. 2. The *sphincter ani* is very powerful, and arises from the under surface of that caudal vertebra which is situated directly above the anus, its origin being interposed between those of the depressors of the tail. The muscle is two inches in breadth, and invests not only the extremity of the rectum but also the anal glands together with the pouch into which these open. It is inserted into the skin midway between the anus and scrotum. By means of this arrangement the sphincter ani acts not only as such upon the anus and anal-gland pouch, but also as a compressor of the anal glands. The gland-pouch resembles the corresponding structure in the female, being transversely oval in form. The anal glands are two in number, one being placed on each side of the rectum. They are oval in form and nodulated on the surface. Each measures $1\frac{1}{4}$ inch in length and $\frac{1}{2}$ inch in greatest breadth. They are thus considerably smaller than the corresponding glands in the female, in which they measure $2\frac{1}{2}$ inches in length and $1\frac{1}{2}$ inch in breadth. The gland consists of a secreting wall $\frac{1}{8}$ inch in thickness, which limits a central cavity. From the posterior extremity of this cavity a duct passes off and opens into the corresponding angle of the anal pouch. The cavity of the gland was filled with a thick secretion, which differed from that of the female in being of a blackish colour and in being destitute of the very offensive odour characteristic of that sex. In addition to these larger glands a belt of isolated follicles extends across the bottom of the anal pouch. They pour their secretion into the latter by means of the little apertures above described.

Bladder and Urethra.—The bladder is regularly pyriform and of small size, measuring 4 inches in length. As in the female, it passes gradually into the urethra, so that it is difficult to say where the one ends and the other begins. It is completely covered by peritoneum as far back as the openings of the ureters, and is attached to the pelvic and abdominal walls by reflections of that membrane. The ligaments thus formed are three in number, two being superior and one inferior. Each superior ligament is attached by one extremity to the superior and supero-lateral pelvic wall, and by the other to the lateral aspect of the bladder. Each consists of a double fold of peritoneum, in the anterior or free margin of which is placed the fibrous cord formed by the obliterated hypogastric artery; and crossing the inner side of the latter from before backward as they enter the pelvis are the ureter and the vas deferens, the ureter being uppermost. The inferior vesical ligament is sickle-shaped, and consists of an elongated fold of peritoneum, which extends between the ventral surface of the bladder and the anterior abdominal wall as far forward as the umbilicus. The ureters are remarkably thick and muscular, and open into the base of the bladder half an inch from the orifice of the urethra. The urethra extends from the bladder to the extremity of the penis, and consists of two portions, a membranous and a spongy. The membranous portion lies within the pelvic cavity, and reaches from the neck of the bladder to the bulb of the urethra. It measures 3 inches in length, and is surrounded between the openings of the vasa deferentia and the bulb by a thick layer of circularly arranged muscular fibres, the superficial fibres being attached to the peritoneal fold which intervenes between the bladder and rectum, whilst the deeper fibres are confined to the urethral wall. On slitting open this portion of the canal a well-marked longitudinal fold of mucous membrane is seen to extend along its floor from the neck of the bladder as far as the middle, in length, of the membranous part of the urethra, where it gradually disappears. Upon the summit of this fold, and 1 inch in front of the neck of the bladder, is a circular opening $\frac{1}{6}$ of an inch in diameter. This opening is the mouth of a very minute recess, on the fundus of which the two vasa deferentia terminate. The recess evidently represents the vesicula prostatica, but does not, so far as I could ascertain, form a central *cul-de-sac* extending beyond the openings of the vasa, as it does in another species of this genus. The prostate gland is altogether absent—a fact difficult to reconcile with Professor Flower's observation, that in a preparation of the male organs of *H. crocuta* in the Museum of the Royal College of Surgeons this gland measures "half an inch in length and rather less in breadth"[1].

The spongy portion of the urethra lies within the penis, and measures 8 inches in length. It is surrounded by a layer of erectile

[1] Since the above was in type I have had, through the kindness of Professor Flower, an opportunity of examining the organs from which his description was taken, and can bear testimony to the truth of his observations regarding the presence of a prostate gland. It consisted of two distinct masses, each measuring half an inch in length and a quarter of an inch in breadth, the ducts of

tissue, which is of considerable thickness where it forms the bulb, but is thin elsewhere. Opening into the bulb are the ducts of Cowper's glands.

Testicles and Vasa deferentia.—The testicles are lodged in the non-pendulous scrotum, which is divided into two distinct compartments by a median septum. Each compartment is lined by a tunica vaginalis, which is reflected over the testicle. The cavity of the sac is continuous at the abdominal ring with that of the peritoneum, the communication between them remaining pervious. The testicle is oval in form, and measures $1\frac{1}{4}$ inch in length. The epididymis lies along its lower side, and is expanded above and below to form the globus major and minor. The latter is nearly as large as the former; and the so-called body of the epididymis is consequently reduced to a mere rudiment. The vas deferens, continuous with the globus minor, passes through the inguinal canal, enters the pelvic cavity, where it lies between the layers of the superior ligament of the bladder, and finally sinks into the muscular wall of the membranous portion of the urethra to terminate along with its fellow on the floor of the vesicula prostatica as already described. There are no vesiculæ seminales.

Cowper's Glands.—These are two in number and of large size. Each is placed alongside of the membranous portion of the urethra, in the interval between the levator ani and ischio-cavernosus muscles. Each gland is pyriform, and measures $1\frac{1}{4}$ inch in length, and $\frac{5}{8}$ of an inch in greatest breadth. The base is directed forward; and from the apex is given off a duct $\frac{3}{4}$ of an inch in length, which opens into the roof of the bulbous portion of the urethra. The glands are solid; and each is provided with a capsule of pale muscular fibres.

Penis.—This organ is composed of two corpora cavernosa together with a corpus spongiosum. The former consist of two bands of erectile tissue flattened from side to side as in the clitoris of the female, and united along the middle line. Each is attached to the ischium just in front of the tuberosity of that bone, to form the crus, and unites with its fellow opposite the posterior extremity of the pubic symphysis. The corpus spongiosum is perforated by the urethral canal, and expands anteriorly and posteriorly to form the glans and the bulb. With the exception of these portions, this mass of erectile tissue is thin and contributes no great thickness to the wall of the urethra. The bulb is large and prominent, and is invested by the fibres of the bulbo-cavernosi muscles. The corpus spongiosum of the male therefore differs from the corresponding structure in the female, inasmuch as in the latter this body is divided into two lateral halves which are situated altogether *above* the urino-genital canal, whilst in the former they have coalesced to form a

which open into a little recess on each side of the utriculus. As this animal was *known* to be at least twenty-four years of age, whilst my specimen was not adult, it is *possible* that by reason of their small size the prostate glands of the latter may have escaped my observation. In Mr. Flower's specimen the other generative glands were each twice as large as in my own.

single mass surrounding the canal of the urethra. Further, in the female the corpora spongiosa take no part in the formation of the glans clitoridis, whilst in the male the glans penis is formed by the spongy body. The penis, formed as just described, measures 8 inches in length from the bulb of the urethra to the apex of the glans.

Muscles of Penis.—Of these there are three which are bilateral, and one which is common to both sides. (1) The *ischio-cavernosus* or *erector penis* is very strong, and arises from the ischium immediately in front of the tuberosity. The fibres pass forward and are inserted into the corresponding corpus cavernosum close to the junction of the latter with its fellow on the opposite side. The muscle covers the crus penis. (2) The *bulbo-cavernosus* is also strong, and arises from a median tendinous band which separates it from its fellow. The fibres pass transversely outward so as to cover the bulb of the urethra, and are inserted into the corpus cavernosum along the inner border of the preceding muscle. (3) *Retractor penis.* In my paper on the female organs of *H. crocuta* I expressed my belief that the retractors of the clitoris probably arise from either the ischium or pubis. I am now satisfied from my examination of those of the male that such is not the case, but that in both sexes they arise from the lower surface of the sacrum. In the male each retractor is a broad but thin muscle which, arising from the pelvic surface of that bone, passes backward and downward and reaches the side of the rectum. Some of the fibres terminate on the gut, where they lie under cover of the levator ani; but the greater number form a narrow riband-like muscle, which passes downwards and extends along the under-surface of the penis in contact with its fellow to be inserted, as in the female, into the corpus cavernosum just behind the glans. (4.) *Elevator urethræ.* The muscle so named is very strong, being nearly as thick as the erector. It is a flattened band, and arises from the inner surface of the ischium 1 inch in front of the tuberosity. The fibres pass downward and forward, and terminate below the angle formed by the junction of the membranous and spongy portions of the urethra on a tendon which is common to it and to the muscle of the opposite side. Lying, as it does in the normal position of the animal, *below* the urethra, this tendon when the muscular fibres contract will tend to elevate and at the same time to compress the urethral canal. A large artery, vein, and nerve derived from the pudics pass together along the outer side of each cavernous body as in the female, and terminate close to the glans. Another artery of large size, also derived from the pudic trunk, passes into the crus penis of each side, and apparently supplies the erectile tissue.

Comparison of the Male Organs of allied Species.—Having now described the male organs of *H. crocuta*, it may be well to compare them with those of closely allied species. The number and arrangement of the anal glands is similar in both sexes of this species; and therefore there is little to add to what I have already said regarding them in my communication on the female organs. In my descrip-

tion of these glands in the latter sex I pointed out that in respect of them *H. crocuta* agrees more closely with *Proteles* than with any species of its own genus, and may merely add that the present dissection has enabled me to confirm Dr. Murie's observation [1] that in the male animal as in the female an anal-gland pouch is present. Mr. Busk [2] had previously convinced himself "that no trace of a pouch between the root of the tail and the anus exists, at any rate in the male of this species;" and Dr. Murie, in deference to Prof. Kaup's [3] attempt to classify the Hyænas in accordance with the presence or absence of this pouch, was not prepared to deny that it might *occasionally* be absent in the male. I think this matter may now be considered settled, and may merely observe that Goldsmith [4] appears to have been aware of the presence of this pouch in every species of Hyæna before any of the authors referred to had written on the subject.

With reference to the male organs of allied species, I find that Daubenton [5] describes and figures those of *H. striata*; and these are also referred to by John Hunter [6] and Owen [7]. Cuvier [8] gives an account of the male organs of Hyæna without indicating the species to which they belong; but from the agreement between his observations and those of the authors just named, I presume that *H. striata* formed the subject of his investigations. Of the male organs of *H. brunnea*, so far as I can ascertain, we know nothing; but of those of the closely allied genus *Proteles*, Prof. Flower [9] gives an accurate description. *H. striata* and *Proteles* agree with *H. crocuta* with respect to the form and position of the scrotum, the form of the testicle, and the absence of vesiculæ seminales, whilst they differ from the last-named species in the possession of a prostate gland. Mr. Flower, it is true, refers to the presence of a prostate gland in *H. crocuta* [10]; but of the absence of this in the specimen I examined I was careful to convince myself; and until further observations are made, it is impossible to reconcile these opposing statements regarding a matter of fact. In *H. striata* the prostate is large and consists of two kidney-shaped lobes, whilst in *Proteles* it consists of a single mass of large size having "the appearance of a bilobed disk." Cowper's glands are large and of the same form in all three species, which likewise agree in the form of the bladder and the very muscular character of the ureters. With respect to the vesicula prostatica, Leuckart [11] describes and figures it in *H. striata* as a minute flask-shaped *cul-de-sac* projecting beyond the urethral wall and lying in the interval between the lobes of the prostate. He says, moreover, that in that animal it does not open into the urethra.

[1] Trans. Zool. Soc. vii. p. 503.
[2] Journ. Proc. Linn. Soc. vol. ix. p. 71.
[3] Isis, 1828, p. 1144.
[4] Animated Nature, "Hyæna."
[5] Buffon's Hist. Nat. tom. ix.
[6] 'Essays and Observations,' by Owen, vol. ii. p. 58.
[7] 'Anatomy of Vertebrates,' vol. iii. p. 671.
[8] 'Anatomie Comparée,' vol. v.
[9] Proc. Zool. Soc. 1869, p. 491.
[10] Ibid. p. 493.
[11] 'Cyclopædia of Anatomy,' vol. iv. Art. "Vesicula prostatica."

Mr. Flower found no distinct uterus masculinus in *Proteles*; but as he refers to a median ridge on the floor of the urethra, in which he could detect a very minute aperture, the arrangement appears to be very similar to that described above in *H. crocuta*. In respect therefore of the form of the vesicula prostatica, *H. crocuta* agrees more closely with *Proteles* than with *H. striata*, differing from the latter inasmuch as the vesicula does not project beyond the urethral wall, and in the fact that it communicates with the canal of the same. According to Leuckart it is an extremely rare occurrence that the vasa deferentia open into the vesicula prostatica; but this is certainly the case in *H. crocuta*. The penis of the Spotted Hyæna closely resembles that of *H. striata* and of *Proteles*, differing only from these in the absence of a conical body of cartilaginous consistence which has been described by Cuvier in the glans penis of the former and by Professor Flower in that of the latter. The glans penis in all of them is invested by small recurved spines.

Comparison of the Male and Female Organs of H. crocuta.—When describing the female organs, I remarked that "the arrangement of these is such as to give them a great resemblance to those of the males in other species," and that, if we supposed the vesicula prostatica of the latter enlarged to the size of the female uterus, we should in the absence of a prostate gland, have an almost identical arrangement of the excretory passages of both sexes. The absence, as a matter of fact, of the prostate gland in the male *H. crocuta* makes the resemblance between the male and female organs of this species even greater than I anticipated. And here I may be permitted to observe that nowhere in the group of mammals is the truth of the conclusions at which embryologists have arrived respecting the homologies of the various parts of the sexual apparatus in the two sexes so beautifully shown as in the animal under consideration. Did any doubt remain regarding the similarity of plan upon which these are built up, it would be at once dispelled by an inspection of the sexual organs of *Hyæna crocuta*. In both sexes there is a short urethra opening close to the mouth of the uterus, which organ, in accordance with functional requirements, is of large size in the female, but is reduced to a minimum in the male. In both there is a urino-genital canal extending from the junction of the urinary and sexual canals to the extremity of the penis or clitoris, according to sex; and in both there are two Cowperian glands of large size opening into that canal close to the root of the penis or clitoris. A comparison of the internal genital organs of the two sexes proves conclusively that the lower part of the so-called prostatic, together with the membranous portion of the male urethra, are homologous with the commencement of the urino-genital canal of the female, which canal, in the majority of mammals, is so metamorphosed to form the vestibule, that its homologue in the other sex is by no means readily recognizable. This homology is further substantiated, in the animal we are considering, by the size and form of Cowper's glands, and the points of entrance of the ducts of these into the urino-genital canal in each sex. Lastly, the homology of the so-

called spongy portion of the male urethra with that portion of the urino-genital canal which, in the female, lies in relation to the clitoris, is manifest. The erectile organ is of the same size, and constructed upon the same plan, in both sexes, the only difference being that in the female the urino-genital canal is not surrounded by the erectile tissue of the corpus spongiosum as is the case in the male, this difference being due to the fact that in the latter the essentially bilateral spongy bodies have coalesced in the middle line, whilst in the female, in accordance with physiological requirements, they remain distinct throughout life, and do not surround the sexual canal. In the female, moreover, and associated with this arrangement, there is a complete absence of the elevator urethræ and bulbo-cavernosi muscles.

It may be well now to ascertain whether the examination of this animal throws any light upon the subject of the probable homologues of the vagina and uterus in the male mammal. The majority of embryologists (among whom I may mention the names of Leuckart, Kölliker, and Allen Thomson) are now agreed that the so-called utriculus of the male mammal represents both the uterus and vagina of the other sex, these organs being formed by the coalescence of the ducts of Müller. I have, however, in a previous paper remarked concerning the corpus uteri of the female *H. crocuta*, "That the whole of this is to be regarded as corpus uteri, and not as constituting any portion of the vagina, is proved by the absence of any constriction in its interior which might correspond to an os uteri, the tubular body of the uterus remaining of the same calibre, and having the walls of uniform thickness down to its opening into the urino-genital canal." It is evident therefore that in the female *H. crocuta*, the vagina being altogether absent, we must conclude that in the male of this species the utriculus represents the uterus alone, and not the uterus and vagina together. The same remark holds good, so far as I can ascertain, of only one other placental mammal—that is, of the Indian Elephant, in the female of which, as Mayer[1] pointed out, the vagina is altogether absent, and the uterus opens directly into the urino-genital canal. In the male, therefore, of that animal, as in that of *H. crocuta*, the utriculus, as shown by Leuckart[2], clearly corresponds to the uterus, and to the uterus alone, of the female. With reference to the homologue of the prostate gland in the female mammal, this, according to Prof. Allen Thomson[3], is to be looked for in tissue uniting the urethra with the vagina. We might therefore be justified in expecting that in those animals in the female of which the lower ends of the Müllerian ducts unite to form the uterus and not the vagina, the prostate gland would be absent in the male. Such is certainly the case in *H. crocuta*; but that it would be erroneous to accept this as a general law is proved by a reference to the Elephant, in which, although the vagina is absent in the female, the male nevertheless possesses prostate glands of con-

[1] Nova Acta Acad. Cæs. Leop.-Car. tom. xxii. p. 38.
[2] 'Cyclopædia of Anatomy,' vol. iv., Art. "Vesicula prostatica."
[3] Quain's 'Anatomy,' 8th edit. vol. ii. p. 826.

siderable size. There appears, indeed, upon consideration, to be no reason why these glands should not be present in the males of those species the females of which want the vagina, as well as in those in which that organ is present, seeing that in both cases we have to do with the tissue surrounding the lower ends of the Müllerian ducts.

Turning now to the external genital organs, I have before directed attention to the very close resemblance which in respect of these the male bears to the female, the so-called scrotal pouches and clitoris of the latter closely simulating the scrotum and penis of the other sex. After a very minute examination of these parts in both sexes I have only been able to recognize the following by no means very evident points of distinction between them: (1) In the female the diameter of the free portion of the clitoris, including the prepuce, is greater than in the male, measuring 1½ inch in the former, and 1 inch in the latter. (2) The aperture at the extremity of the clitoris of the female is slightly larger and much more dilatable than the corresponding aperture in the male. This difference depends on the fact that the corpus spongiosum in the male forms the glans penis and completely surrounds the urethral aperture, whilst in the female the upper portion only of the glans is composed of erectile tissue, its lower portion being formed by the walls of the urino-genital canal. (3) The glans penis of the male is covered with recurved spines, whilst the glans clitoridis of the female is devoid of these. (4) In the male the cutaneous surface immediately behind the free portion of the penis is covered with hair, whilst in the female the corresponding space is dotted with the little cutaneous depressions I formerly described, and is devoid of hair.

It will at once be seen that these points of distinction are slight, and are not such as would enable one to decide the sex of the animal in the absence of such an examination as is well nigh impossible so long as the animal is alive.

Bisexual Nature of the Hyæna according to the Ancients.—And this leads me to observe, what I formerly stated, that the consideration of these facts may serve to explain the ideas which were common among the ancient Greeks regarding these animals, namely that they were hermaphrodites. Since the date of my former communication, I have endeavoured to come to some conclusion regarding the origin of this apparently extraordinary belief, with the result that it appears to me that a belief which in our day would rightly be considered altogether absurd, by no means deserves to be so characterized when viewed in the dim light of the knowledge possessed by the ancients respecting these animals. These people had apparently, either directly or indirectly, ascertained certain facts regarding the sexual organs of the Hyæna, which, in the absence of more definite knowledge, almost compelled them to adopt what I may call the bisexual theory regarding them—a view which, as I formerly stated, still obtains among the imperfectly educated Boors of South Africa. Among the Greeks, Aristotle[1] (B.C. 384) appears to have been the first who really investigated the sexual organs of the Hyæna;

[1] 'Historia Animalium,' vi. 32.

but that the genus was well known before his time is proved, first, by the fact that Herodotus[1] (B.C. 484) speaks of the animal as being met with in the Libyan desert, and, secondly, that the view in accordance with which each individual was bisexual, was current before the time of Aristotle, who takes pains to show its absurdity. At a later date Pliny[2] reasserts the bisexual nature of these animals; and his assertion is repeated by Ælian[3]. As, however, with one exception, to which I shall by-and-by refer, the observations of the last two historians do not contain any thing of importance which had not been previously stated by Aristotle, we may confine ourselves to a criticism of the writings of the latter; and by doing so I think we shall throw some light on the origin of the view in question. Aristotle says[4]:—"The Hyæna resembles a Wolf in colour, but is more shaggy, and its back is provided with a mane. It is said that it has the genital organs of both sexes at once; but this is not the case. Its male organ resembles that of the Wolf and Dog; and it has what resembles a female organ under the tail. But this last, although similar to the female organ in form, is imperforate. Underneath this again is the fæcal passage. The female Hyæna has this same so-called female organ situated as in the male, just under the tail; but it is imperforate. Next to this is the fæcal passage; and under this again is the true female organ. The female Hyæna, moreover, possesses an uterus like other female animals. The female Hyæna is rarely caught. Hunters maintain that for ten males they catch but one female." With regard to this passage, the first question that arises is as to the particular species of Hyæna which Aristotle himself examined. There can, I think, be no doubt that it was either *H. brunnea* or *H. striata*, but most probably the latter. His description of the female organs is such as enables us to decide that it was certainly *not H. crocuta*, inasmuch as he says that the gland-pouch had been mistaken for the female organ, showing that the former had some resemblance to the latter. But the female organ of *H. crocuta* bears no resemblance whatever to the gland-pouch; therefore it must have been the female organ of another species to which he referred. In favour of *H. striata* is (1) his observation that the animal is provided with a mane, which, as we know, is more evident in the Striped Hyæna than in *H. brunnea*; and (2) the geographical distribution of the two species—the Striped Hyæna being found in abundance in Northern Africa, with the topography and productions of which the Greeks were well acquainted, whilst *H. brunnea* is confined to the central and southern districts of that continent, districts with which the Greeks were by no means so familiar. But if we come to the conclusion that either *H. striata* or *H. brunnea* formed the subject of Aristotle's investigation, I would point out that in denying, as the result of his observations, the bisexual character of either of these animals, he is attempting to refute a hypothesis the origin of which (as referring to them) it is impossible to explain, seeing that the male and female external organs of

[1] Rawlinson's Herodotus, vol. iii. p. 172.
[2] Pliny, viii. 30.
[3] 'Historia Animalium,' i. 25.
[4] *Loc. cit.*

both species differ widely in appearance, and that consequently the sexes of each are readily distinguishable one from the other.

If this be granted, we need not further attempt to explain an assertion, the origin of which has no foundation in *fact*. But that this hypothesis did originate with reference to either of these species I am not prepared to admit, as it appears to me that the bisexual character attributed to the Hyæna allows of a rational explanation if we regard that character as referring not to either *H. striata* or *H. brunnea*, either of which Aristotle *may* have examined, but to *H. crocuta*, which he certainly did *not* examine. And as further showing that in all probability Aristotle unwittingly mixed up and confounded reports regarding totally distinct animals, I would direct attention to two of the sentences above quoted, in one of which he says, "It is said that it (the Hyæna) has the genital organs of both sexes at once;" and in another "The female hyæna is rarely caught. Hunters maintain that for ten males they catch but one female." Passing over the evident inconsistency of these two statements, I have already shown that the first is inexplicable when applied to either *H. striata* or *H. brunnea*; and, in like manner, the second is equally devoid of meaning when regarded as having reference to either of these species, inasmuch as we have no reason to believe that the proportion in number of the sexes is different in either of them from what it is in other carnivorous mammals, or that the female of either is more difficult of capture than the male. We conclude, therefore, that if the bisexual theory of the ancients regarding the Hyæna had any foundation in fact at all, such fact had reference not to either *H. striata* or *H. brunnea*; and by a process of exclusion we are compelled to regard it as having reference to *H. crocuta*. I have already shown that it is almost impossible to distinguish the female of this species from the male by the mere inspection of the external genital organs; and in this fact lies, as I believe, the explanation of the views held by the ancients regarding these animals. This explanation is moreover borne out by Aristotle's observation that "the female Hyæna is rarely caught," a fact which Pliny also records. The latter historian makes a further, with reference to the present inquiry important observation which is not to be found in the writings of Aristotle. He says, "It is a matter of common belief that the Hyæna is bisexual, *and that it is male and female in alternate years*." It is evident here that Pliny, like Aristotle, mixes up distinct reports concerning the animal, as it requires no elaborate argument to show that were the animal bisexual it did not require to change its sex every year. Be this as it may, it appears to me that if we consider these various statements as referring to *H. crocuta*, the origin of all of them admits of a rational explanation. It might well be that the ignorant traders who trafficked with the natives of the interior of the African continent, observing that all, or at least the majority, of the Hyænas which they encountered were apparently males, should have experienced some difficulty in accounting for the continuance of the species, and have had recourse to the view that each animal was bisexual. It is not improbable that, as Aristotle explains, this view

may have been borne out by the presence of an anal pouch, which, according to him, was mistaken for the female organ—an explanation which is rational enough if we consider that *H. crocuta* formed the subject of the hypothesis, but one which, as I have already shown, loses all its force if we regard it as referring to either of the other species of Hyæna. I would add that the other statements of the historians already quoted, to wit that the Hyæna changes its sex every year, and that the female is rarely caught, are equally explicable in accordance with this view. The first of these I regard as another attempt to solve the problem of generation, seeing that the animals, to the eye of the observer, were uniformly of the male sex; whilst the latter is merely a statement of fact. It may be urged that the geographical distribution of *H. crocuta*, confined as that animal is to the region of Africa lying south of the Sahara[1], and consequently beyond the ken of the Greeks, is against this view. But I may be permitted to point out that it is almost certain that in their time, as now, trading caravans from the coast visited these districts and conveyed to the Greeks information regarding the animals which inhabited them; otherwise it is impossible to account for the accurate knowledge which Herodotus undoubtedly possessed regarding the African continent as far to the south-west as the valley of the Niger[2]. In all probability the statements of travellers regarding the bisexual nature of the Hyæna, originating with *H. crocuta*, were transferred by the Greeks to *H. striata*, with which they were better acquainted—statements which when taken as referring to the latter species are absolutely devoid of meaning, but which, when regarded as applying to the former, admit, as it appears to me, of a rational explanation.

I have, in conclusion, to acknowledge the kindness of Dr. Alfred Young in preparing the illustrations for this paper.

EXPLANATION OF THE PLATES.

Plate XXIV.

View of the male perineum and penis of *Hyæna crocuta*. From above downwards are seen the orifice of the anal-gland pouch, and anus; below the latter is the scrotum, together with the bare perineal integument; lowest of all is the penis, surrounded by its prepuce.

Plate XXV.

Fig. 1. Male generative organs and extremity of rectum of *Hyæna crocuta*. G. P, glans penis; Pr, prepuce; S, scrotum seen from the side; P, penis; C. P, crura penis, covered by the ischio-cavernosi muscles; B. U, Bulb of urethra, covered by the bulbo-cavernosi muscles; R. P, retractor penis muscle; B, bladder; UR, urethra; T, T, testicles, that on the right side lying in its serous sac; V. D, vasa differentia; R, rectum; A. G, anal gland; L. A, levator ani muscle.

Fig. 2. Intrapelvic portion of urethra laid open, showing elevated fold of mucous membrane on its floor, together with the opening of the utriculus on the summit of this fold.

Fig. 3. Glans penis and prepuce of *Hyæna crocuta*. The prepuce is retracted to show the small recurved spines which invest the glans.

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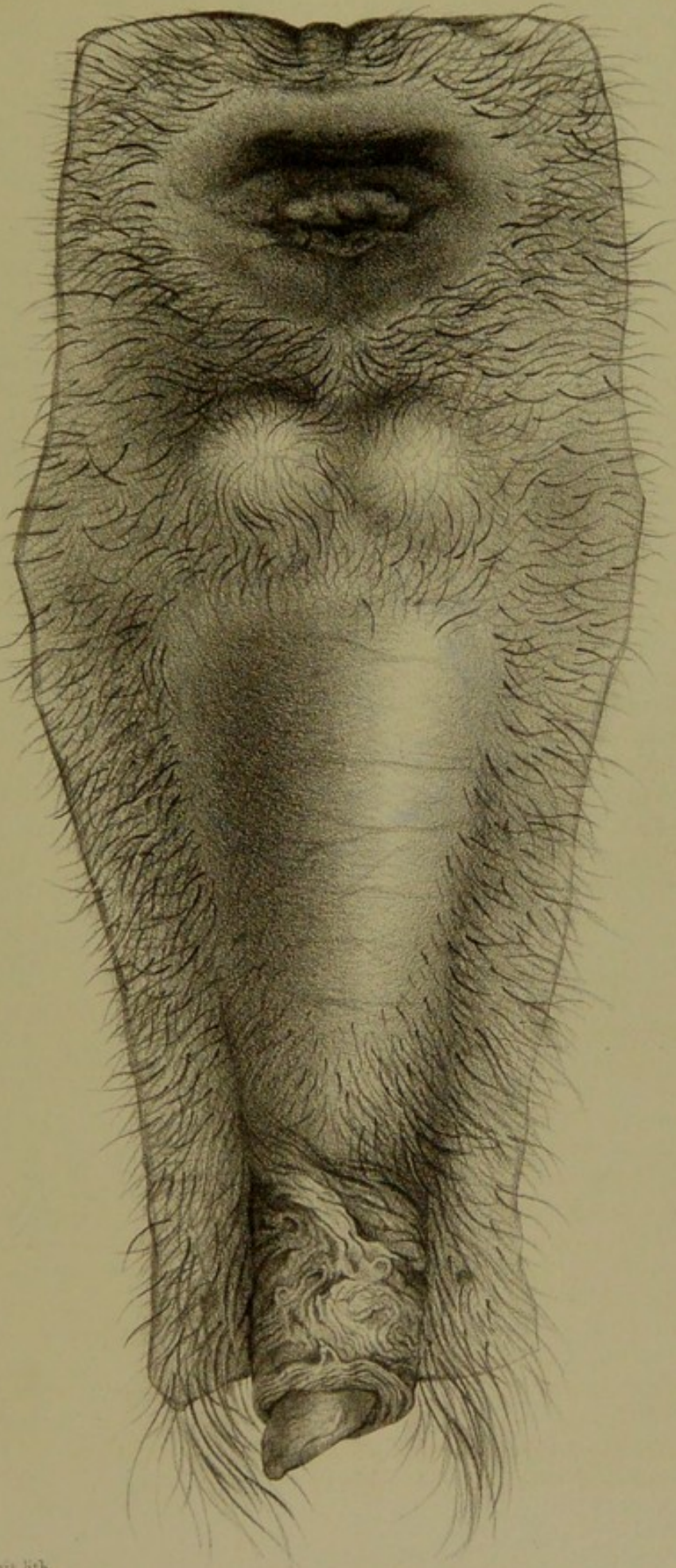
[1] 'Geographical Distribution of Mammalia,' by Andrew Murray.

[2] Heeren's 'Ancient Nations of Africa,' vol. i. p. 192.



A.H.Young M.B. del. J.Smit lith. Hanhart imp

ANATOMY OF HYÆNA CROCUTA.

Fig. 1.

Fig. 2.

AHYoung MB del. JSmit lith.

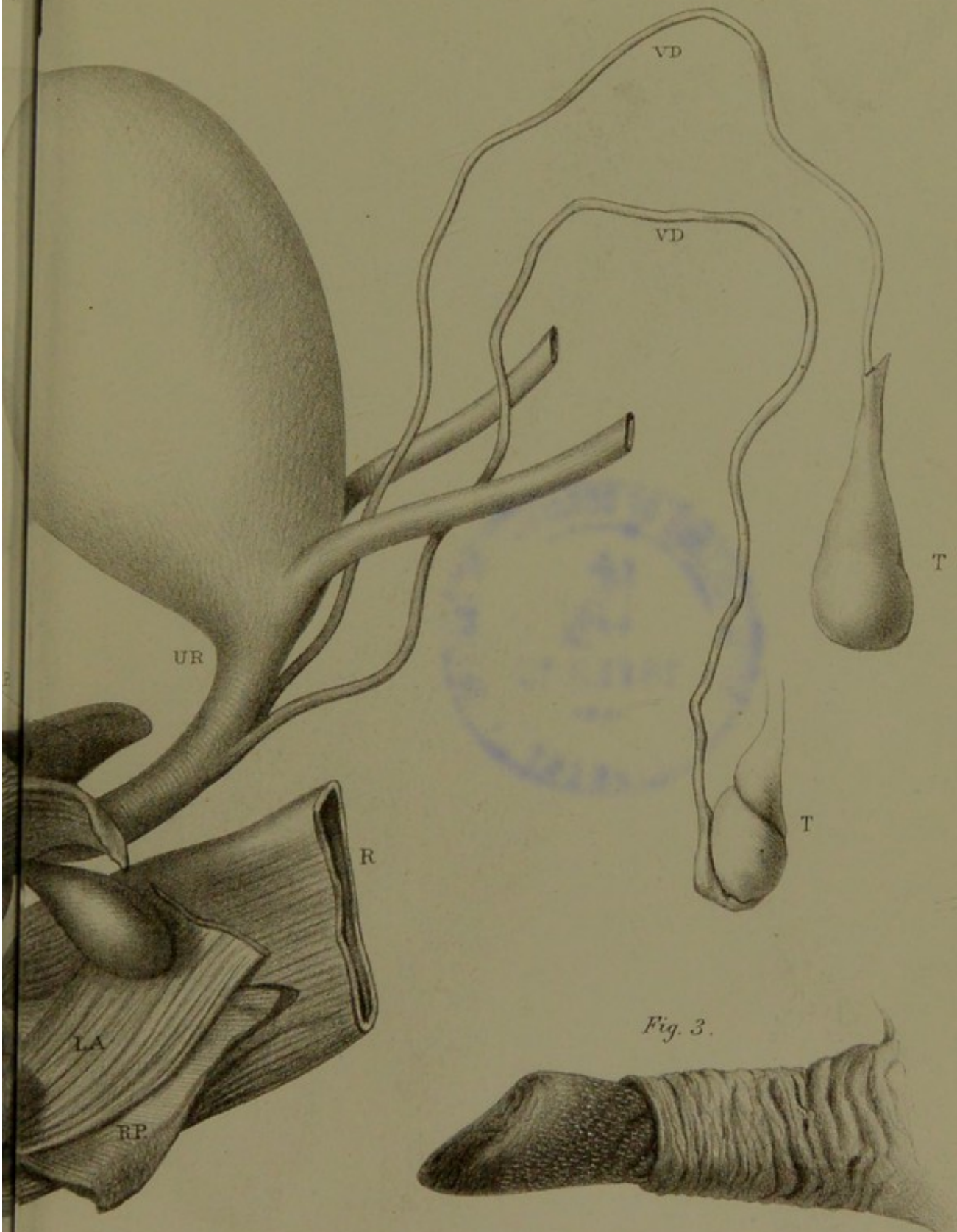


Fig. 3.

Hanhart imp.

ÆNA CROCUTA.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