

Anatomy of The Male Reproductive System

Embryological; the reproductive system is closely related to the urinary system, often both are considered together under the title "Urogenital System".

The male reproductive system consists of:

1. Two testes (testicles) – essential organs.
2. Duct system [epididymis and ductus deferens (vas deferens)].
3. Accessory sex glands.
4. Male urethra and penis.

The testes produce spermatozoa (the male sex cells also called sperm) and testosterone (the male sex hormone). The remaining structures assist the spermatozoa to reach their ultimate goal (the ovum of the female) in a conducive to fertilization of the ovum; these structures include the epididymis and ductus deferens for each testis, accessory sex glands [ampulla, seminal vesicles, prostate, and bulbo-urethral (Cowper's) glands], urethra and penis.

Male fertility and Artificial Insemination

Lecture No (1) T

Dr. Hussein Abbas Al-Rishawi

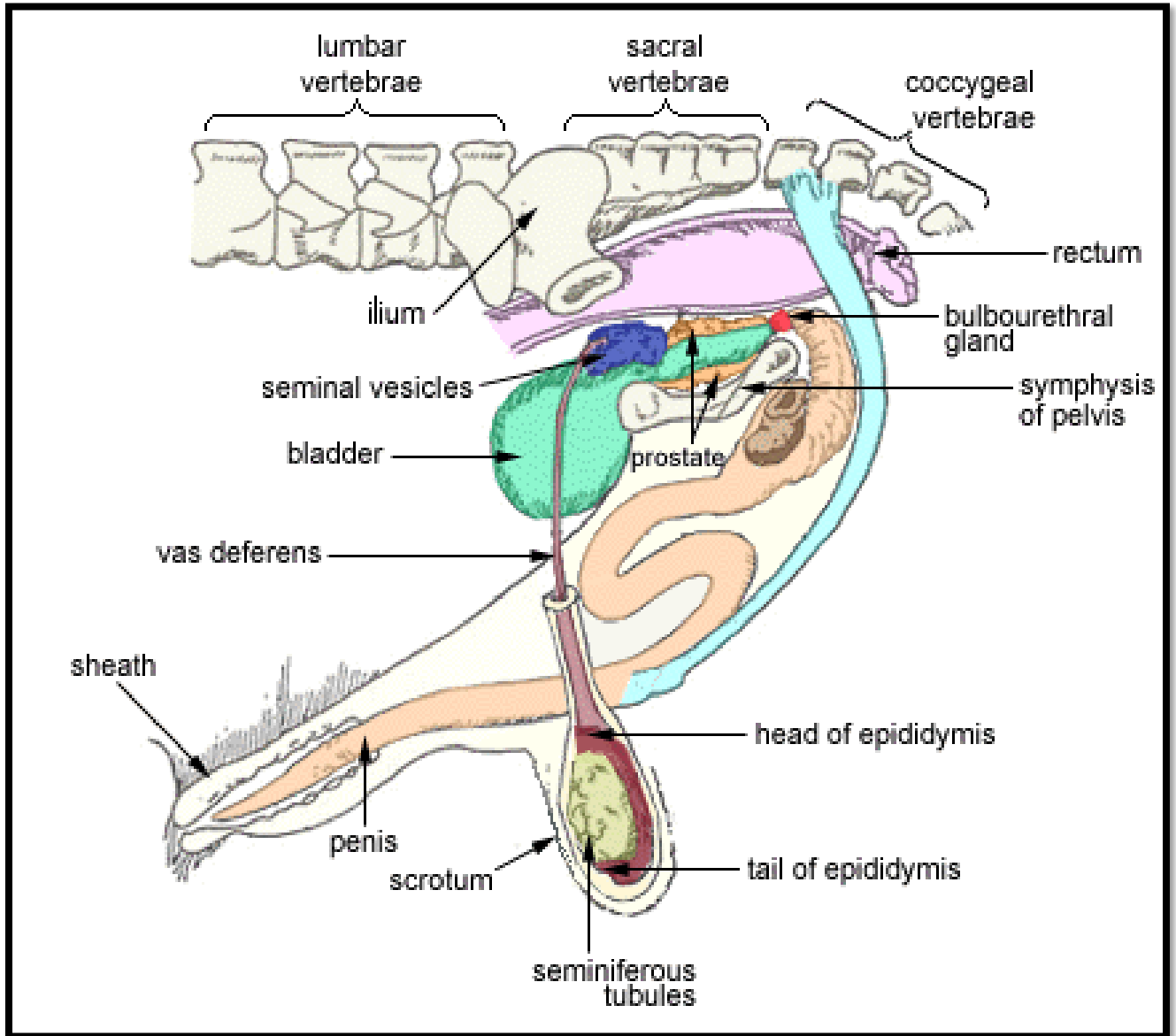


Figure 1 genital organs of bull

SCROTUM

The scrotum is a coetaneous (skin) sac; a layer of fibro-elastic tissue mixed with smooth muscle fibers called tunica dartos. The scrotum provides the favorable environment of a lower temperature for the reproduction of spermatozoa.

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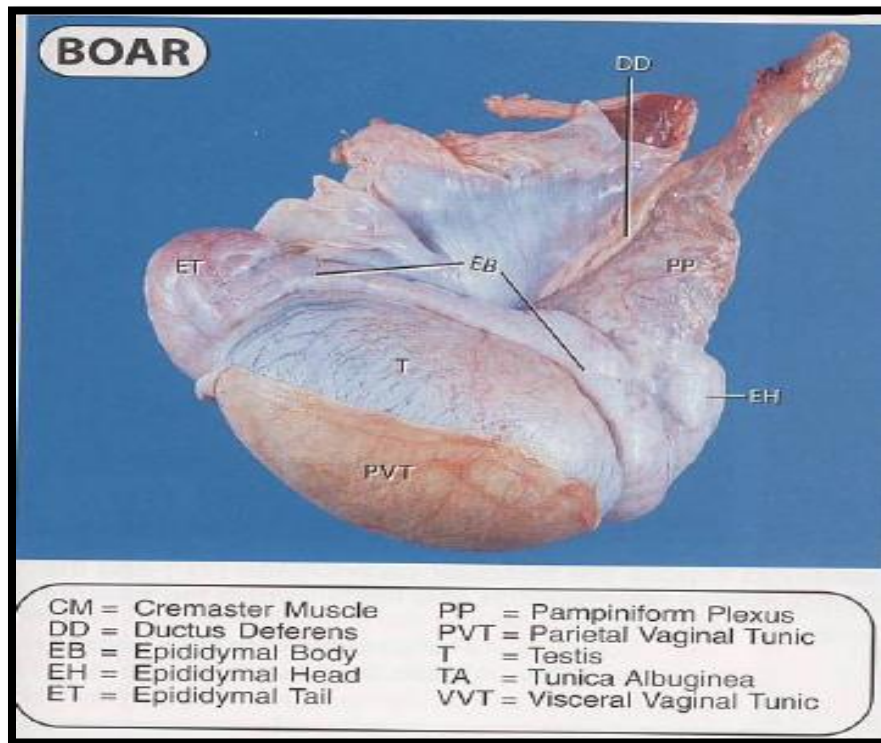


Figure 2 Testis with scrotum of boar

The scrotum is present in all domestic animals, is an out-pouching of skin from the abdominal region, and encloses the testes. It is thin, pliable, and relatively hairless as in horses and camels or hairy as in a bull. By the last third of gestation in domestic animals, the testes are normally located in the scrotum. Failure of the testes to descend into the scrotum results in a condition known as cryptorchidism. If both testes fail to descend (bilateral cryptorchidism), it results in sterility. A unilateral cryptorchidism has a single descended testis; they are fertile but there is a tendency for this condition to be inherited. Males possessing this trait should not be used for breeding. The scrotum consists of five layers from outside to inside as follows:

- 1. Outer layer (the skin or epidermis):** is heavily populated with sweat glands to assist in maintaining proper testicular temperature.
- 2. Tunica dartos:** consists of fibro-elastic tissue and smooth muscle, which is connected closely with the tunica vaginalis at the bottom of the scrotum. The scrotum consists of two pouches, which contain a testicle. The tunica dartos acts as a thermoregulatory by contracting to draw the testes close to the abdomen when cold and relaxing when the testes are warm.
- 3. Stratum subdarticum:** is a loosely woven layer of connective tissue between the tunica dartos and tunica vaginalis-parietal layer. This tissue allows the testes extraordinarily free mobility in an upward and downward direction.
- 4. Parietal tunica vaginalis:** (lines the scrotum) is continuous with the peritoneum.
- 5. Visceral tunica vaginalis:** (covers the testis) is continuous with the peritoneum.

Table 1 Age of testicles descend into scrotum

SPECIS	TIME OF TESTICAL DESCEND
BULL	3.5 _ 4 months of gestation
RAM	Mid gestation (40 days)
STALLION	Between 9 months of gestation and a few days after birth
BOAR	After 85 days of gestation
TOMCAT	2-5 days after birth
DOG	Between the last few days of gestation and the first few days after birth

TESTES

The tests (testicles) vary somewhat from species to species as far as shape, size, and location are concerned, but the essential structure is the same. Each testis consists of a mass of seminiferous tubules surrounded by a heavy fibrous capsule called the tunica albuginea. A number of fibrous septa, or trabeculae, pass inward from the tunica albuginea to form a framework or stroma for support of the seminiferous tubules.

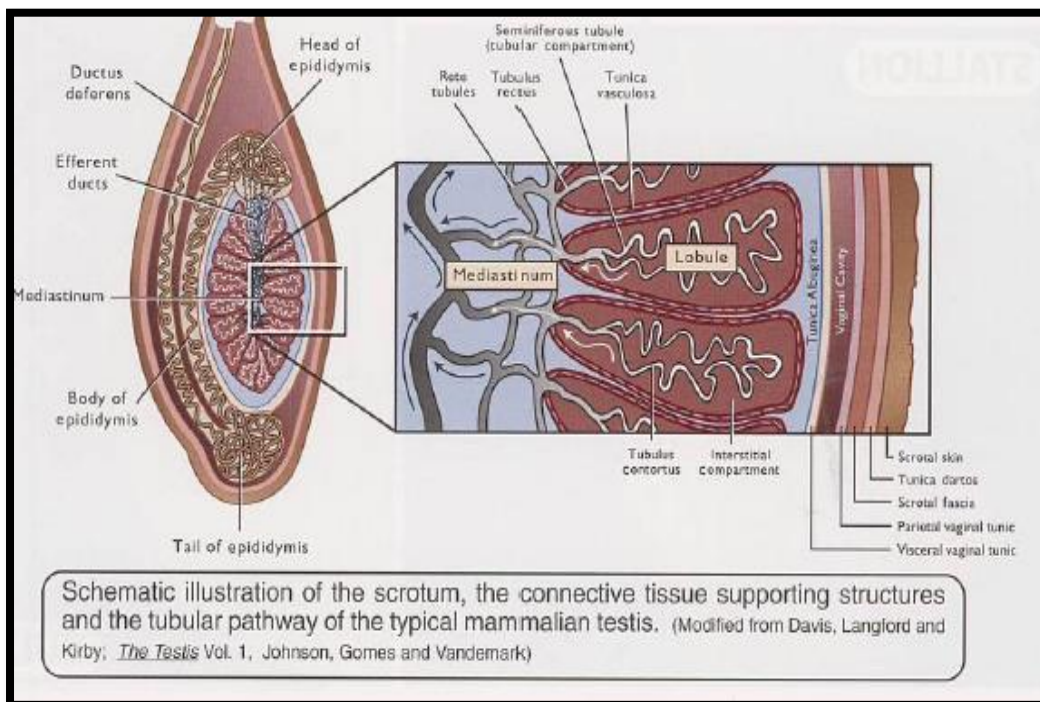


Figure 3 testis show semineferus tubules

In all domestic animals except the horse, these trabeculae unite near the center of the gland to form a fibrous cord (Mediastinum testis). The cells of Leydig, which secrete the male hormone (testosterone), are located in the connective tissue

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between seminiferous tubules. The testis temperature to make its function properly should be less than body temperature (2-4°C). These temperatures regulate by:

- ❖ Muscles of scrotum.
- ❖ Muscles that cover the spermatic cord.
- ❖ Circulating blood in the spermatic cord.

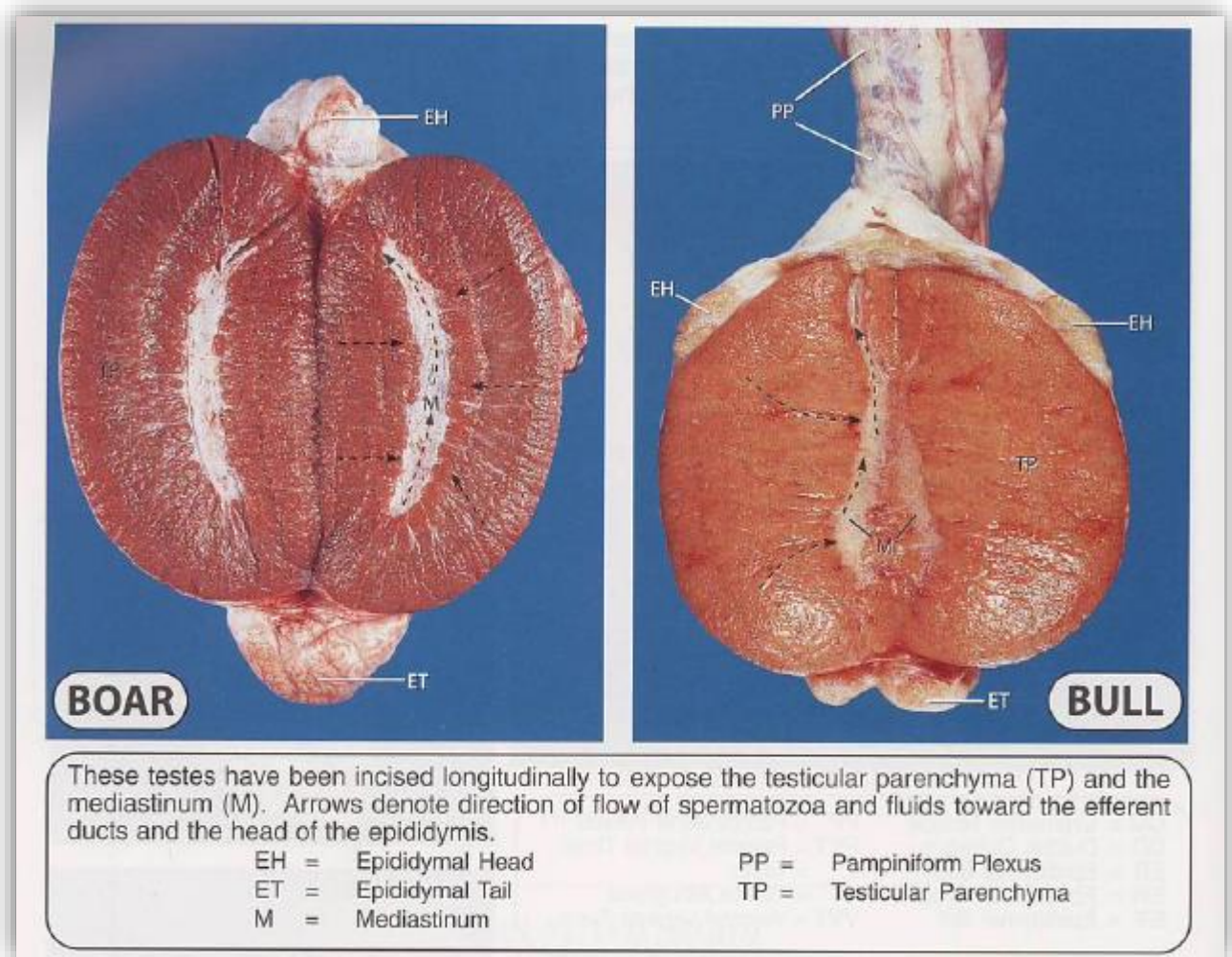


Figure 4 testicular mediastinum

EPIDIDYMIS

The spermatozoa pass from the seminiferous tubules by way of the vasa efferentia to the head of the epididymis. The epididymis is a very long convoluted tube that connects the vasa efferentia of the testis with the vas deference or ductus deferens (33-35 m in bull, 50 m in boar, and 6 m in man). The head of the epididymis attaches to the same end of testis that the blood vessels and nerves enter.

The body of the epididymis parallels the long axis of the testis, and the tail of the epididymis continues as the ductus deferens, which doubles back along the body of the epididymis to the region of the head, where it enters the spermatic cord. The epididymis serves as a place for spermatozoa to mature prior to the time they are expelled by ejaculation. Spermatozoa are immature when they leave the testicle and must undergo a period of maturation within the epididymis before they are capable of fertilizing ova.

DUCTUS DEFERENS

The ductus deferens (vas deferens) is a muscular tube which, at the time of ejaculation, propels the spermatozoa from the epididymis to the ejaculatory duct in the prostatic urethra, its long about 45 cm. The ductus deferens leaves the tail of the epididymis, passes through the inguinal canal as a part of the spermatic cord, and at the internal inguinal ring turns caudally, separating from the vascular and nervous parts of the cord.

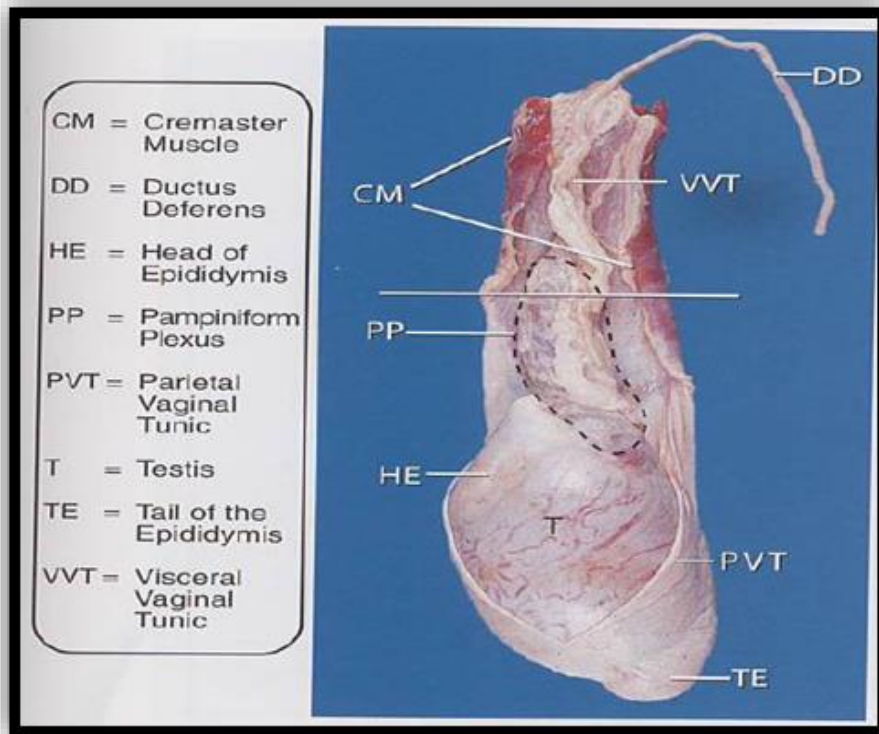


Figure 5 Epididymis and ductus deference

SPERMATIC CORD

As the testis descends from the region caudal to the kidney, it brings with it the same blood, nerve and lymphatic supply present in the embryo. These structures, the testicular vessels and nerves, make up a large part of the spermatic cord that connects the testis with the rest of the body. The spermatic cord also includes the ductus deferens, which connects the tail of the epididymis with the prostatic urethra.

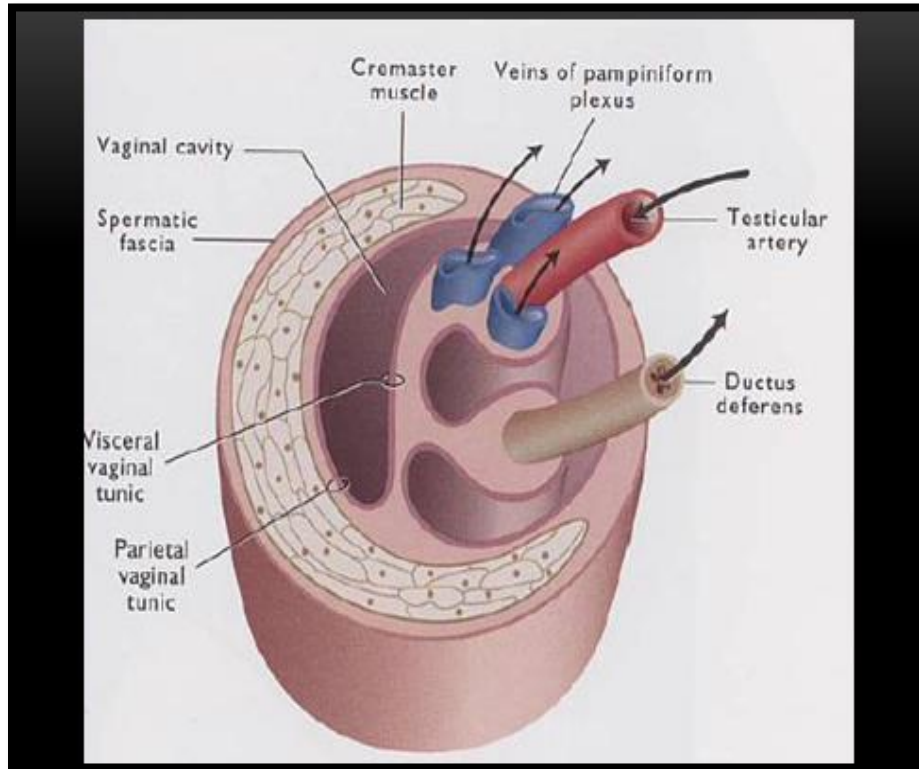


Figure 6 Spermatic cord

INGUINAL CANAL

The inguinal canal is a passage from the abdominal cavity to the exterior that extends from the internal inguinal ring to the external inguinal ring. The inguinal canal is potentially very extensive; it normally is only large enough to permit passage of the spermatic cord and inguinal vessels and nerves. If the internal ring and canal are too relaxed, a loop of intestine may pass through the canal in to the scrotum producing an inguinal hernia. This is particularly likely to happen during the act of breeding.

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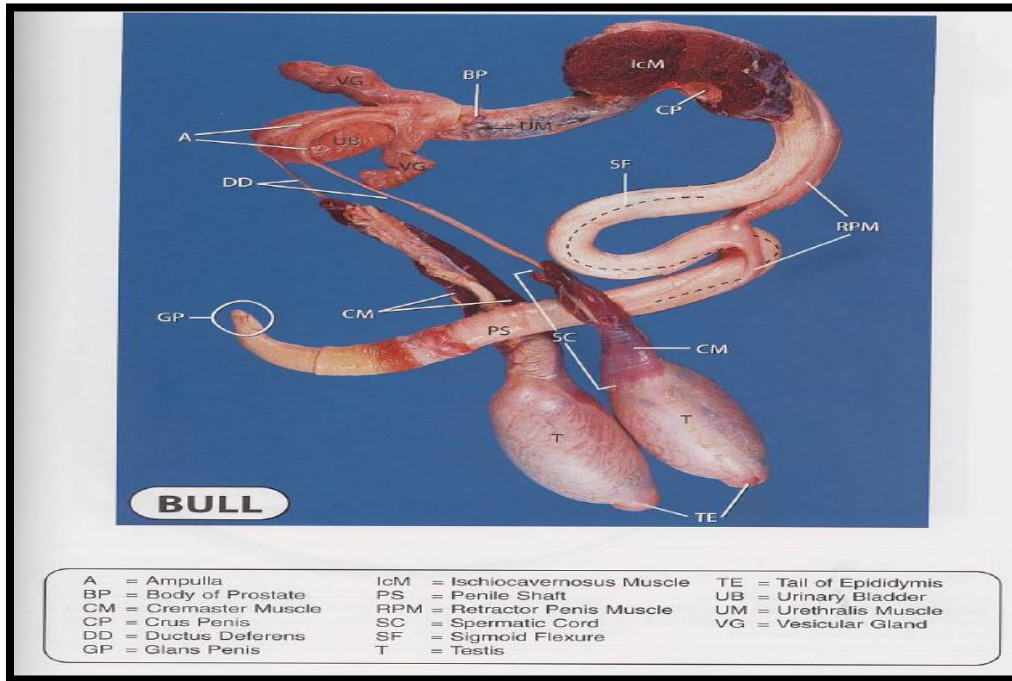


Figure 7 Reproductive organs of bull

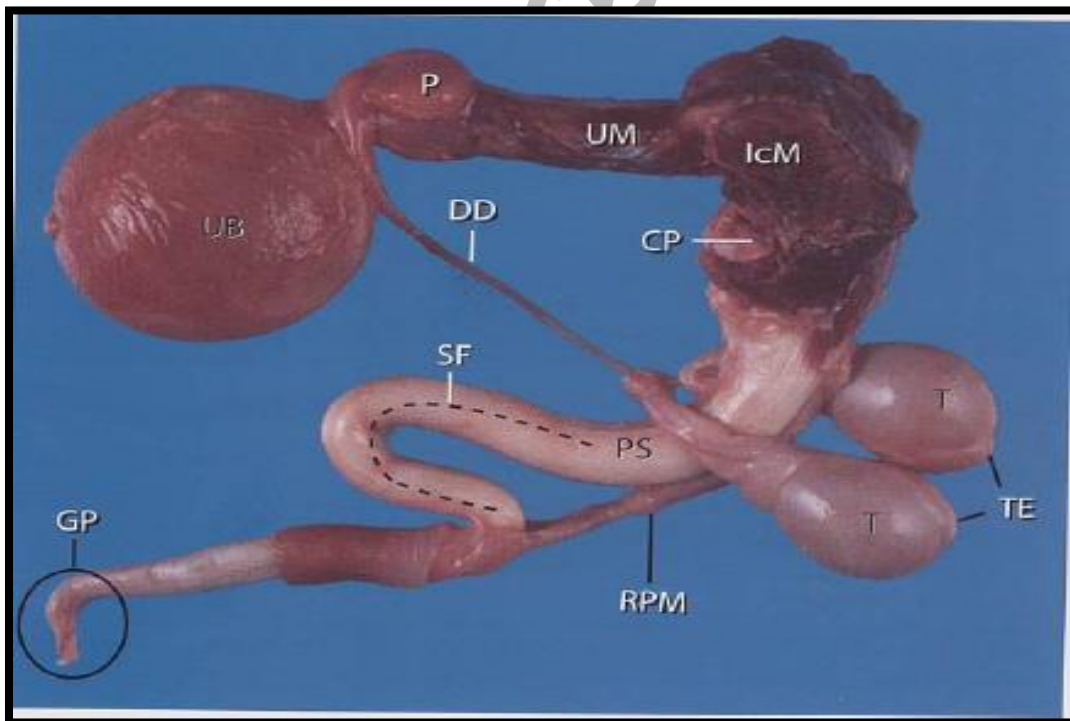


Figure 8 Reproductive organs of camel

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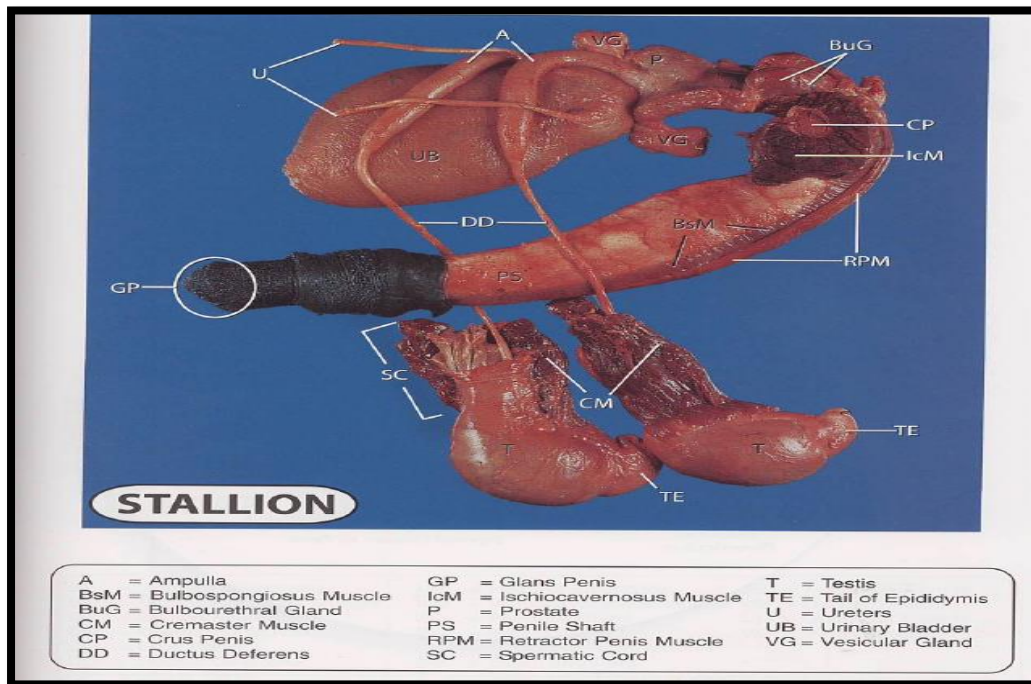


Figure 9 Reproductive organs of stallion

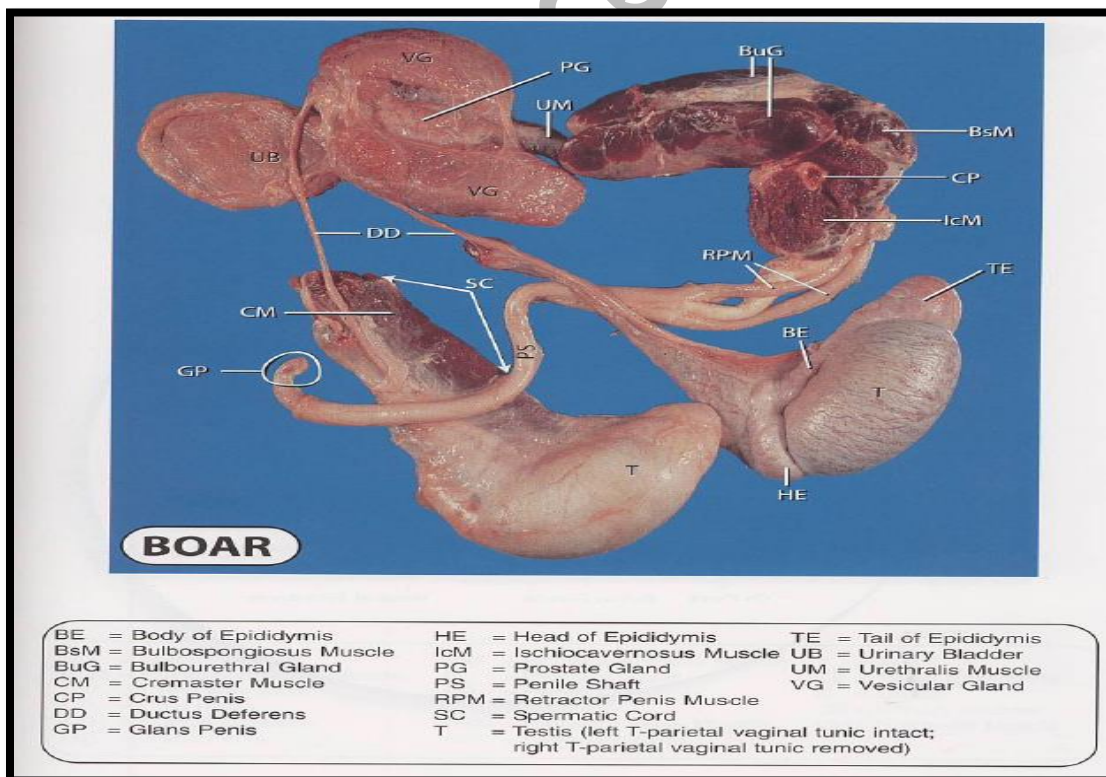


Figure 10 reproductive organs of boar

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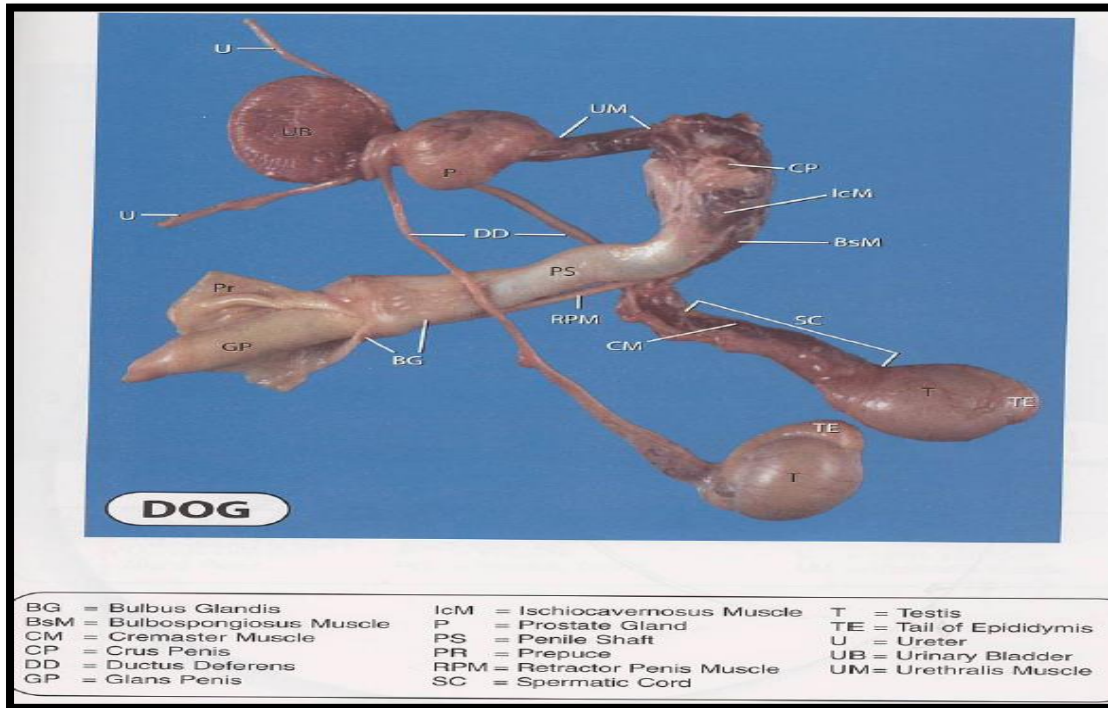


Figure 11 Reproductive organs of dog

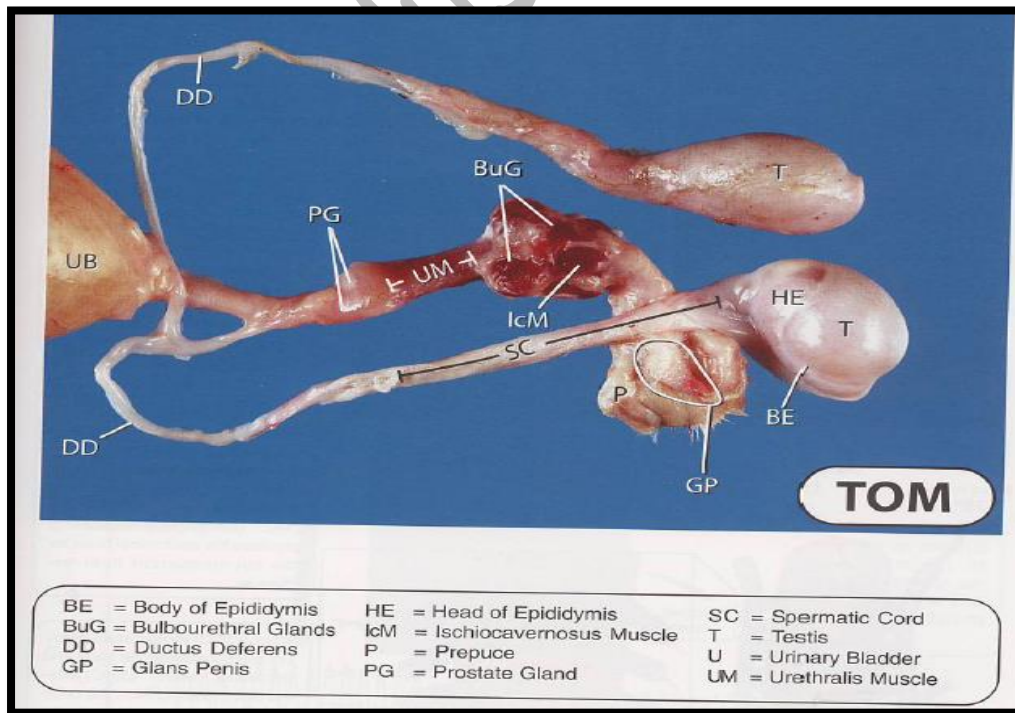


Figure 12 Reproductive organs of male cat (Tomcat)

ACCESSORY SEX GLANDS

The male accessory sex glands produce the bulk of the ejaculate or semen (the medium for transport of sperm). Semen provides favorable conditions for nutrition of sperm and act as a buffer against the natural acidity of the female genital tract. The accessory sex glands include the seminal vesicles, the prostate gland and the bulbo-urethral (Cowper's) glands.

1. AMPULLA

The ampulla is a glandular enlargement of the terminal parts of the ductus deferens. They are well developed in the stallion, bull and ram; small in dog; and absent in boar. The ampulla empty into the ductus deference and contribute fluid to the semen.

2. SEMINAL VESICLES

The seminal vesicles (formerly called vesicular glands) are paired glands associated with the genital fold. They are lobulated (grapes like) in bull, ram and boar, but it is hollow (pear-shaped) sacks in the stallion. Each vesicular gland merges with the ipsilateral ductus deferens, creating the short ejaculatory duct, which empties in to the pelvic urethra. The secretion of seminal vesicles form (20-30%) contain a high concentration of fructose and sorpetol to nourishment the sperms, and its gelatinous assist to lubricant urethra before ejaculation.

3. PROSTATE GLAND

The prostate gland is an unpaired gland that more or less completely surrounds the pelvic urethra, its shape was a discrete shaped like a walnut in dog and stallion. The prostate gland comprises various combinations of diffuse and compact parts extending along the pelvic urethra under cover of the urethral muscles. The prostate produces an alkaline secretion, milky color contains a phosphate lipids, Ca, Mg and Na that gives semen its characteristic odor and form about (30-40%) of semen. In older intact animals, the prostate may become enlarged and interfere with urination.

4. BULBO-URETHRAL GLANDS

The bulbo-urethral (formerly called Cowper's) glands are paired, bean shaped, placed on either side of the pelvic urethra just cranial to the ischial arch but caudal to the other accessory glands. Cowper's glands secrete a viscous gelatinous secretion act to clean the urethra from urine remains and lubricant the penis before copulation.

Table 2 the male sex accessory glands

Species	Prostate	Seminal Vesicles	Cowper's glands	Ampulla
Horse	+	+	+	+
Ruminants	+	+	+	+
Alpaca	+	+	+	+
Pig	+	+	+	-
Dog	+	-	-	+

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Cat	+	-	+	-
+ = present - = absent				

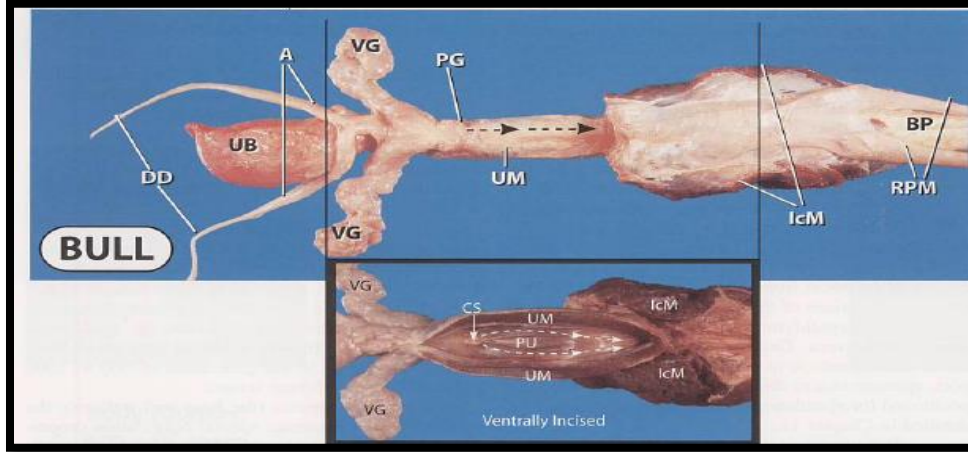


Figure 1 Bull accessory sex glands

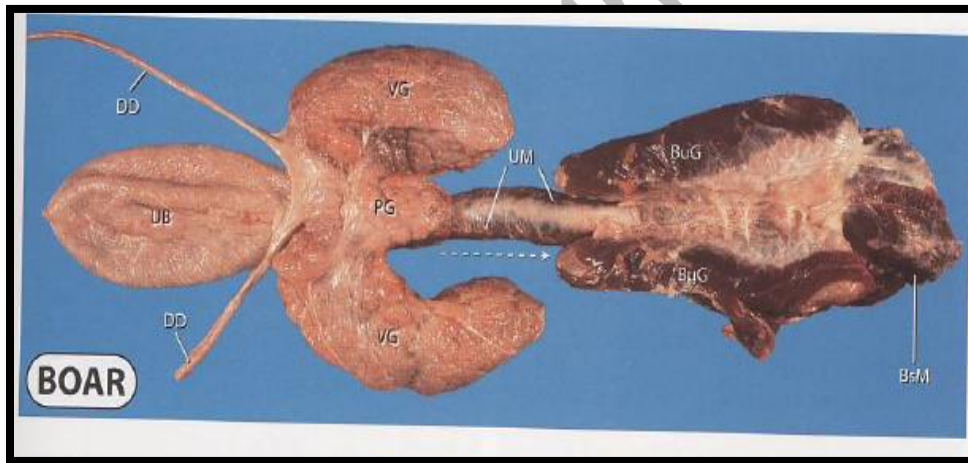


Figure 2 Boar accessory sex glands

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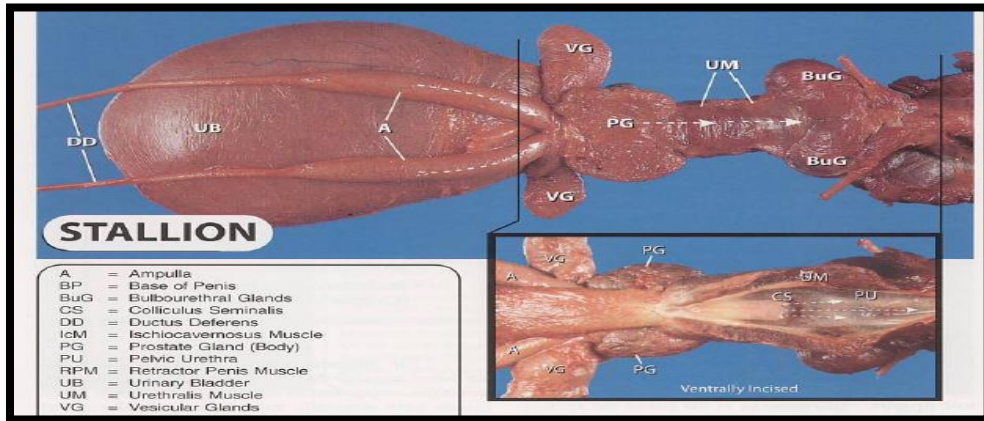


Figure 3 Stallion accessory sex glands

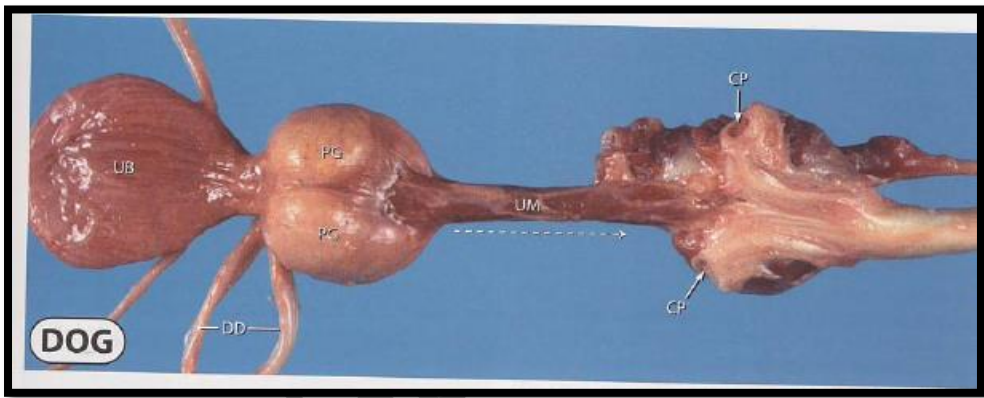


Figure 4 Dog accessory sex glands

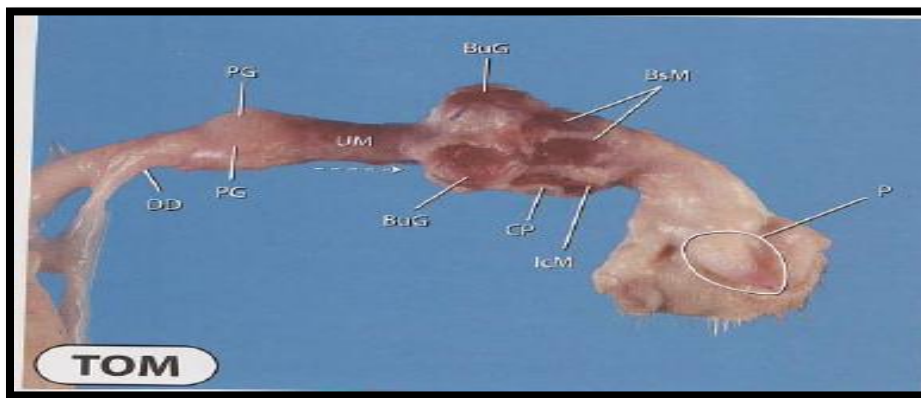


Figure 5 Tomcat accessory sex glands

PENIS

The penis is the male organ of copulation that is composed essentially of erectile tissue. It is long, cylindrical with a very much smaller in diameter. Sigmoid flexure just behind the scrotum, it forms an S-shaped curve, and its position is affected during erection. The penis presents three main parts:

1. **ROOT:** attached to the lateral parts of the ischial tuberosity.
2. **BODY:** constitutes the bulk of the organ.
3. **GLANS PENIS:** the terminal part and free end of the organ.

Muscles of the penis:

1. **Ischio Cavernous:** Short but strong-paired muscle attaches the root of the penis to the ischial arch. Action: pulls the penis against the pelvis.
2. **Corpus Cavernous penis:** it forms the greater part of the bulk of the penis.
3. **Corpus Cavernous urethra:** it is also termed Corpus Spongiosum, forms a tube around the urethra.
4. **Bulbo Cavernous:** present in a circular fashion around the proceeding muscle in a cross-sectional view.
5. **Retractor Penis:** comprises of two strips that is the continuation of the suspensory ligament. Action: to withdraw the penis into the sheath/prepuce after erection.

PREPUCE

The prepuce (or sheath) is an invaginated fold of skin surrounding the free extremity of the penis. The outer surface is typical skin, while the inner mucous

membrane consists of a preputial layer lining the prepuce and a penile layer covering the surface of the free extremity of the penis.

MALE URETHRA:

The male urethra is a long mucous tube, which extends from the urinary bladder to the glans penis. The urethra lies in a groove on the ventral surface of the corpus cavernous penis muscle. The urethra passes caudally on the floor of the pelvis, turns around the ischial arch, forming a sharp bend, and passes forward as a part of the penis, enclosed in the corpus cavernous urethra.

CASTRATION

Castration is a term usually applied to removal of the testis of the male, although technically it can apply to ovariectomy (removal of the ovaries) of the female animal as well. Early castration also improves the quality of meat animal by inhibiting undesirable secondary sex characteristics (notably the failure to develop marbling of muscle).

Table 3 common terms for intact and castrated male animals

Species	Intact Adult Male	Castrated Male
Horse	Stallion	Gelding
Ox	Bull	Steer
Sheep	Ram	Wether
Goat	Buck	Wether
Pig	Boar	Barrow
Chicken	Rooster	Capon

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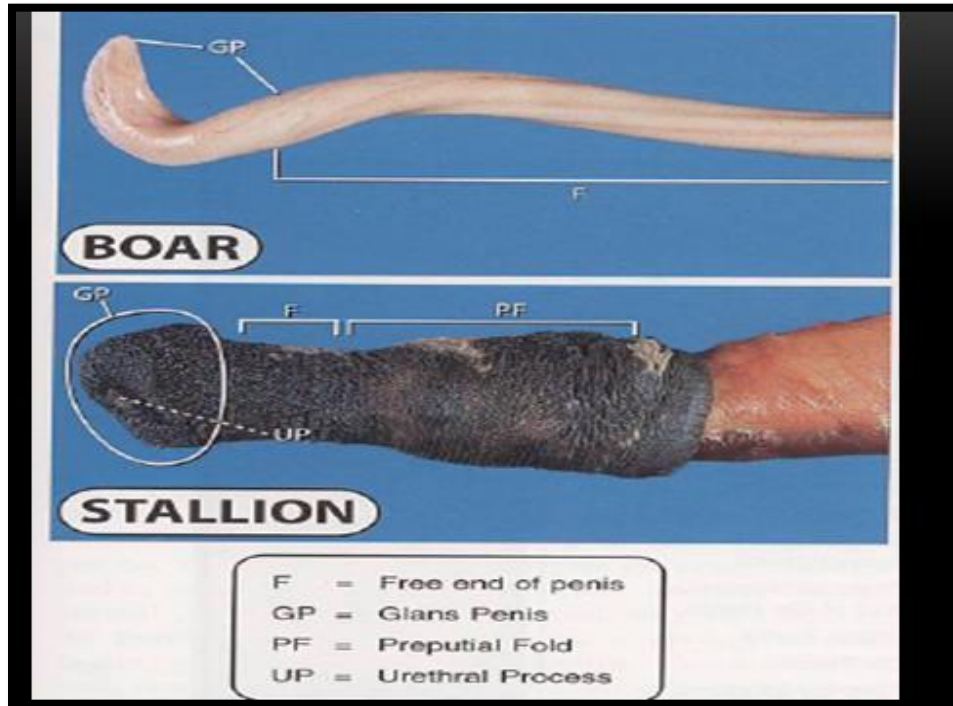


Figure 6 Penis of both boar and stallion

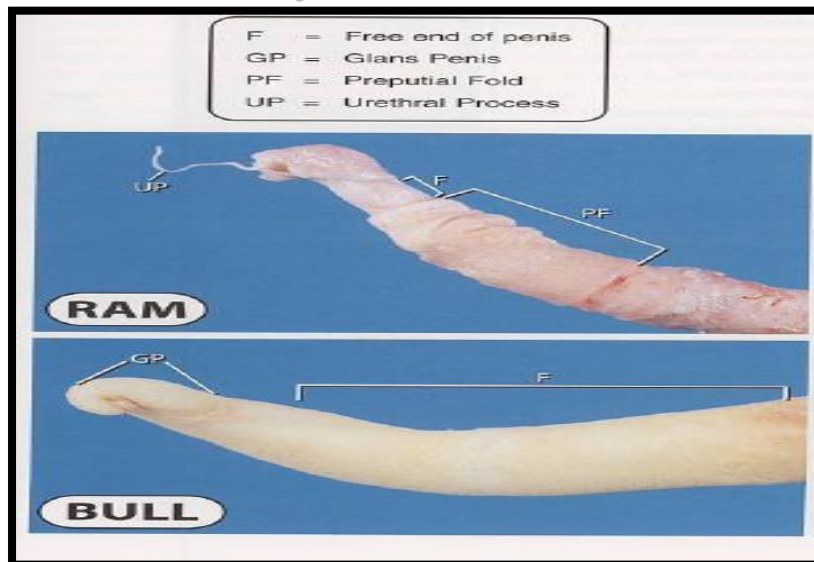


Figure 7 Penis of both ram and bull

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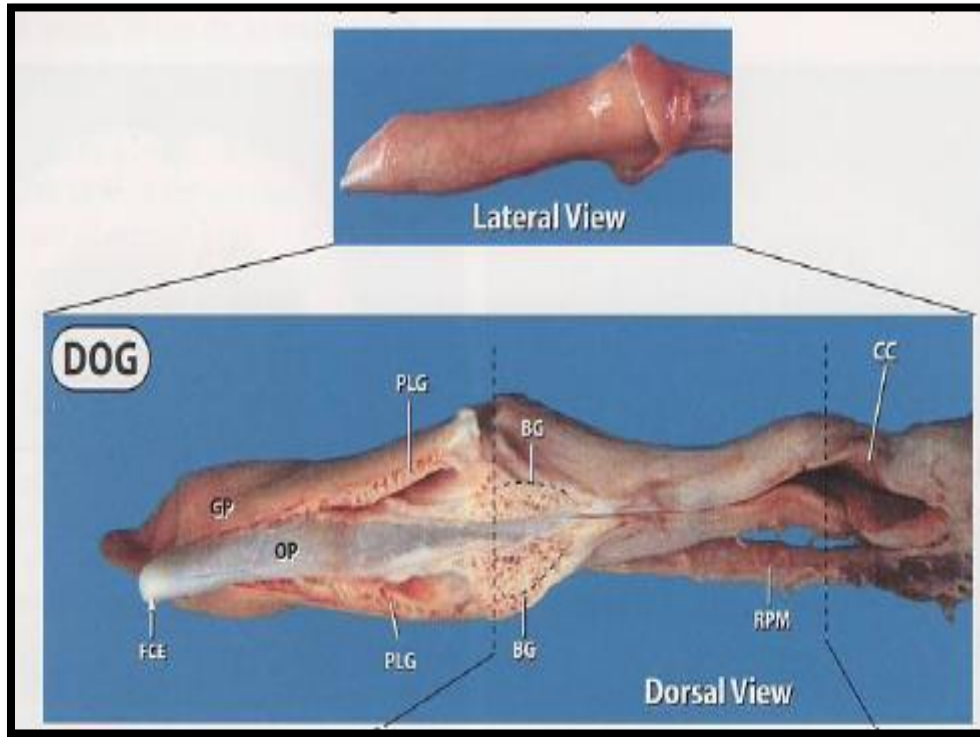


Figure 20 Penis of dog

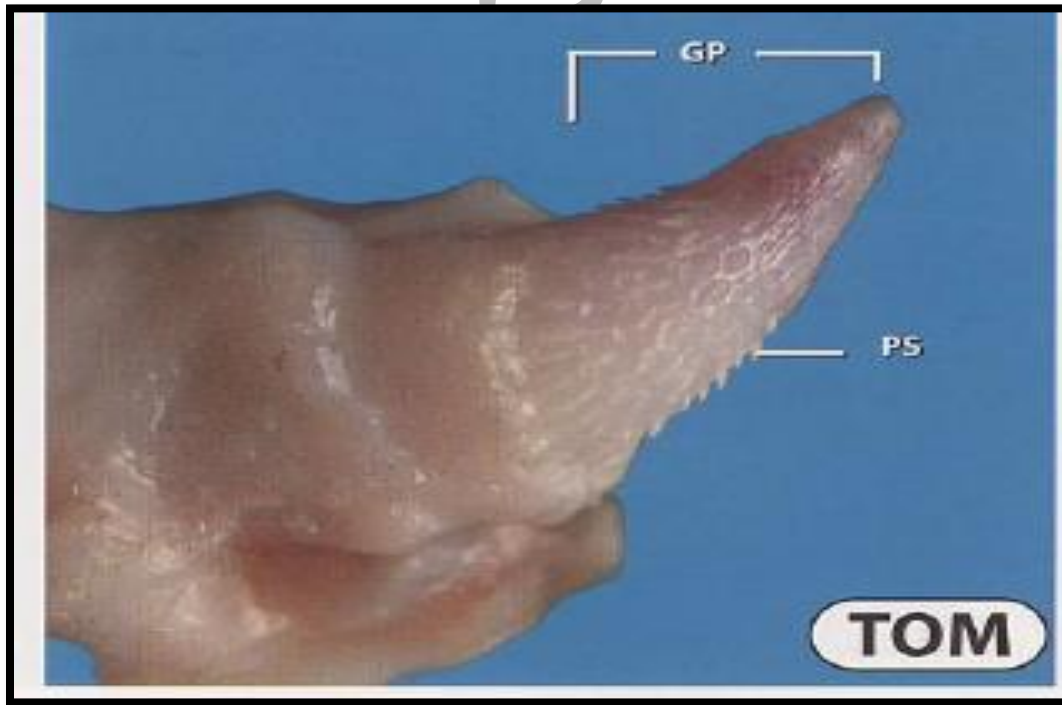


Figure 21 Penis of tomcat