GYNAECOLOGY

(ANDROLOGY)

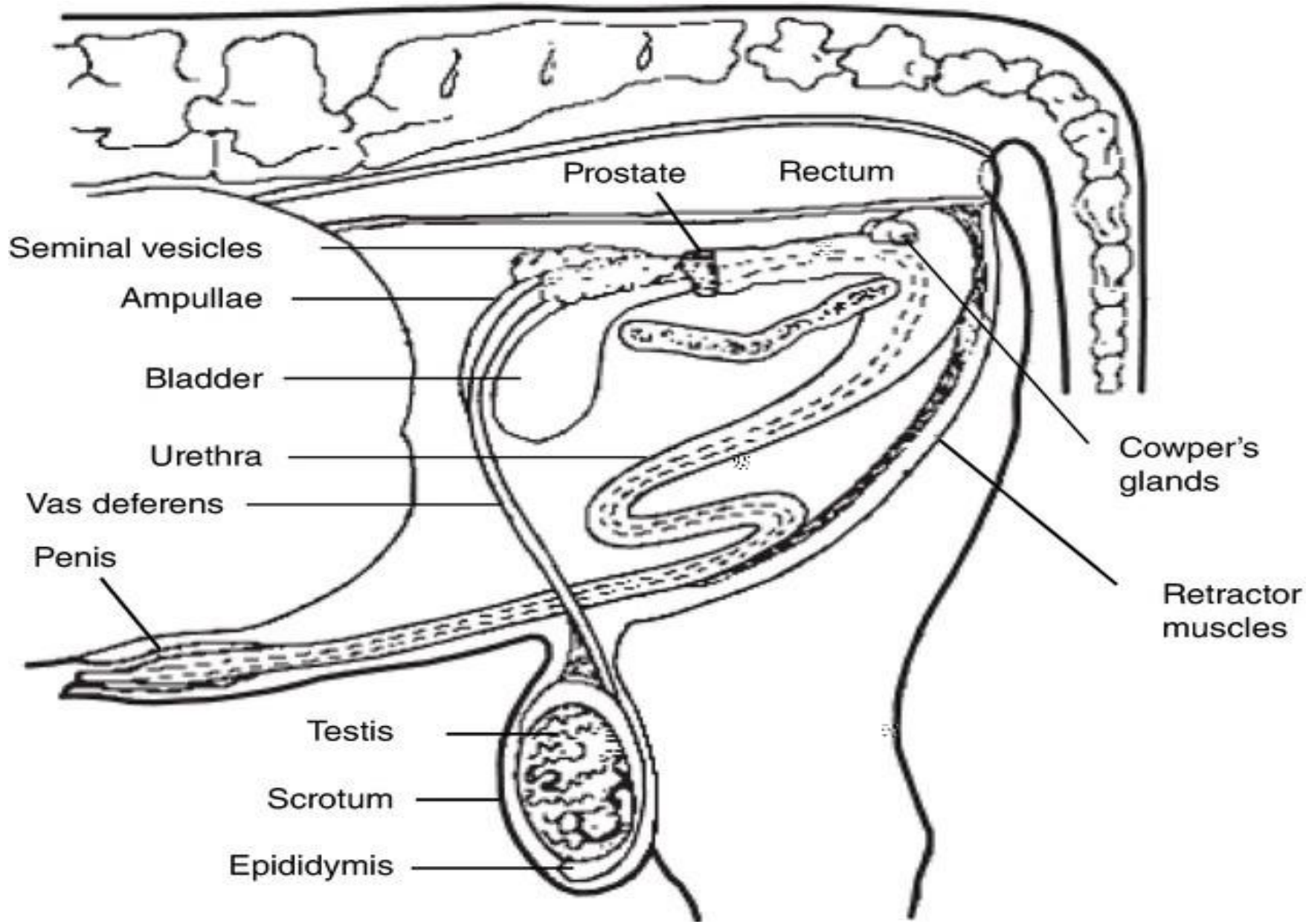
ANIMAL REPRODUCTION

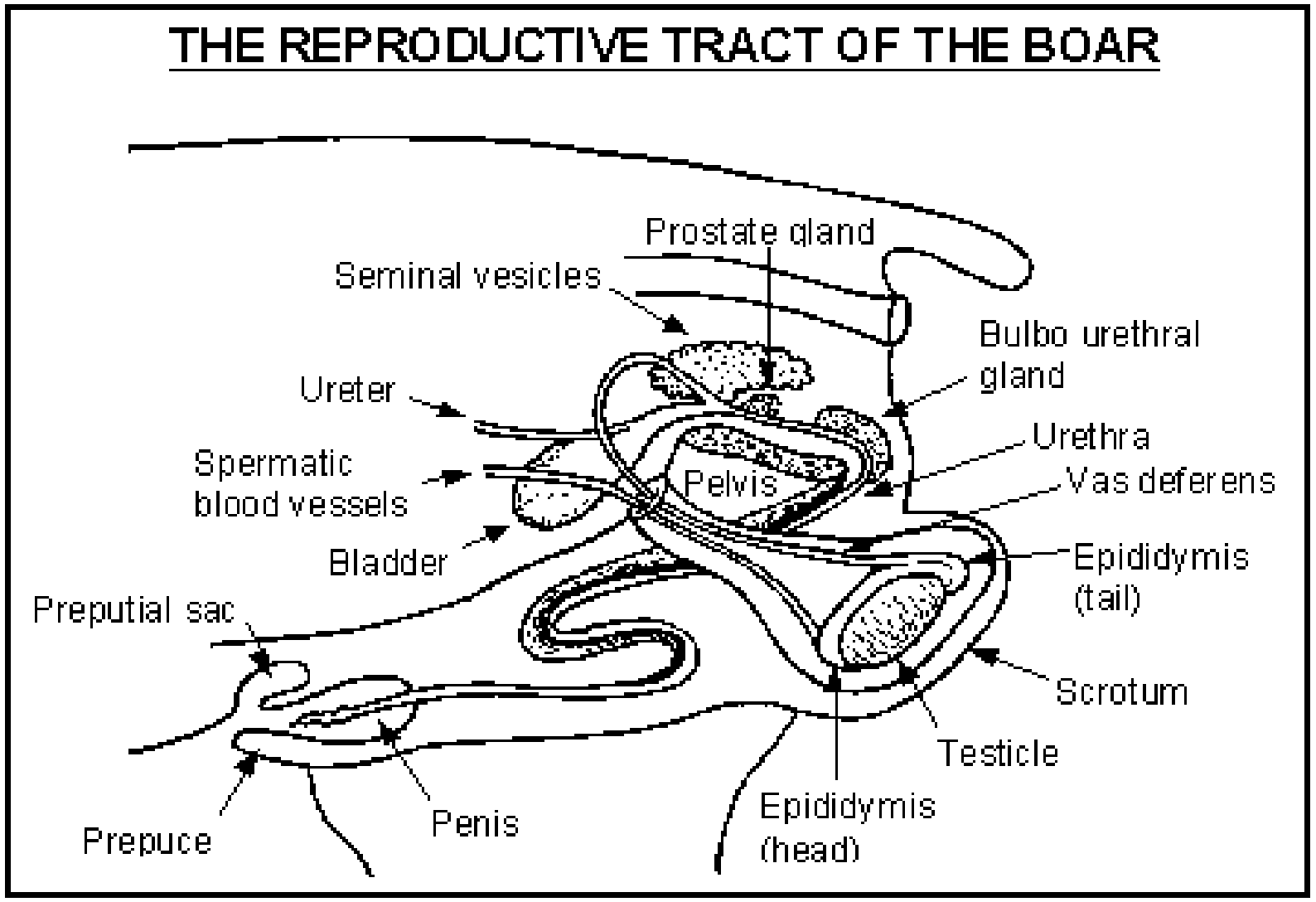
Unit	Name	Topics
Unit 1	Female Reproductive Tract and Oestrous Cycle	1. Anatomy and Embryology of the Female Reproductive Tract 2. Puberty and Sexual Maturity: Endocrine Control 3. Physiology and Endocrinology of the Oestrous Cycle 4. Oestrous Cycle in Equines, Ovines, Caprines, Swines, Canines and Felines 5. Assisted Reproductive Techniques
Unit 2	Female Infertility	1. Fertilisation and Failure of fertilization 2. Infertility and its Management
Unit 3	Veterinary Obstetrics	1. Pregnancy and its Diagnosis 2. Placentation 3. Complications of pregnancy 4. Parturition 5. Dystocia 6. Obstetrical interventions
Unit 4	Veterinary Andrology and AI	1. Comparative reproductive anatomy and endocrinology of male reproductive tract 2. Puberty and Sexual Maturity 3. Semen collection and evaluation 4. Male infertility: Impotentia Coeundi and Impotentia Generandi

ANDROLOGY

LECTURE-1

COMPARATIVE REPRODUCTIVE ANATOMY


Prostate
Rectum
Seminal vesicles
Ampullae
Bladder
Urethra
Vas deferens
Penis
Cowper's glands
Retractor muscles
Testis
Scrotum
Epididymis


THE REPRODUCTIVE TRACT OF THE BOAR
Prostate gland
Seminal vesicles
Bulbo urethral gland
Ureter
Urethra
Spermatic blood vessels
Pelvis
Vas deferens
Epididymis (tail)
Bladder
Preputial sac
Scrotum
Testicle
Epididymis (head)
Penis
Prepuce

(Fig.5-32)

THE MALE REPRODUCTIVE SYSTEM

- Primary sex organ (Gonad) – Testes
- Accessory sex organs:
  - Epididymis: Sperm maturation and storage.
  - Ductus Deferens (Vas Deferens): Transports sperm to the pelvic urethra.
  - Seminal Vesicles (Vesicular Glands): Secrete seminal fluid.
  - Prostate Gland: Produces fluids for semen.
  - Bulbourethral (Cowper's) Glands: Lubricate the urethra.
- Copulatory organ – Penis & Prepuce
- Other components: Scrotum & Spermatic cord

The **urogenital duct development** in cattle involves the **formation and differentiation of structures from embryonic germ layers**, mainly the intermediate **mesoderm**, which gives rise to the urogenital system.

Two key structures form during early embryogenesis:

1. **Wolffian ducts (mesonephric ducts):** These contribute to male reproductive structures.
2. **Müllerian ducts (paramesonephric ducts):** These give rise to female reproductive structures.

2. Development of Urinary System

Pronephros: A transient, non-functional kidney structure appears early but quickly regresses.

Mesonephros: Functions temporarily and contributes to the development of Wolffian ducts in males.

Metanephros: The final functional kidney develops from the ureteric bud and metanephric mesenchyme.

3. Development of Male Urogenital Ducts:

The Wolffian ducts persist in males under the influence of testosterone produced by the fetal testes. Structures formed from the Wolffian ducts include: **Epididymis**, **Vas deferens**, **Seminal vesicles**.

The Müllerian ducts regress due to anti-Müllerian hormone (AMH) secreted by Sertoli cells.

4. Development of Female Urogenital Ducts:

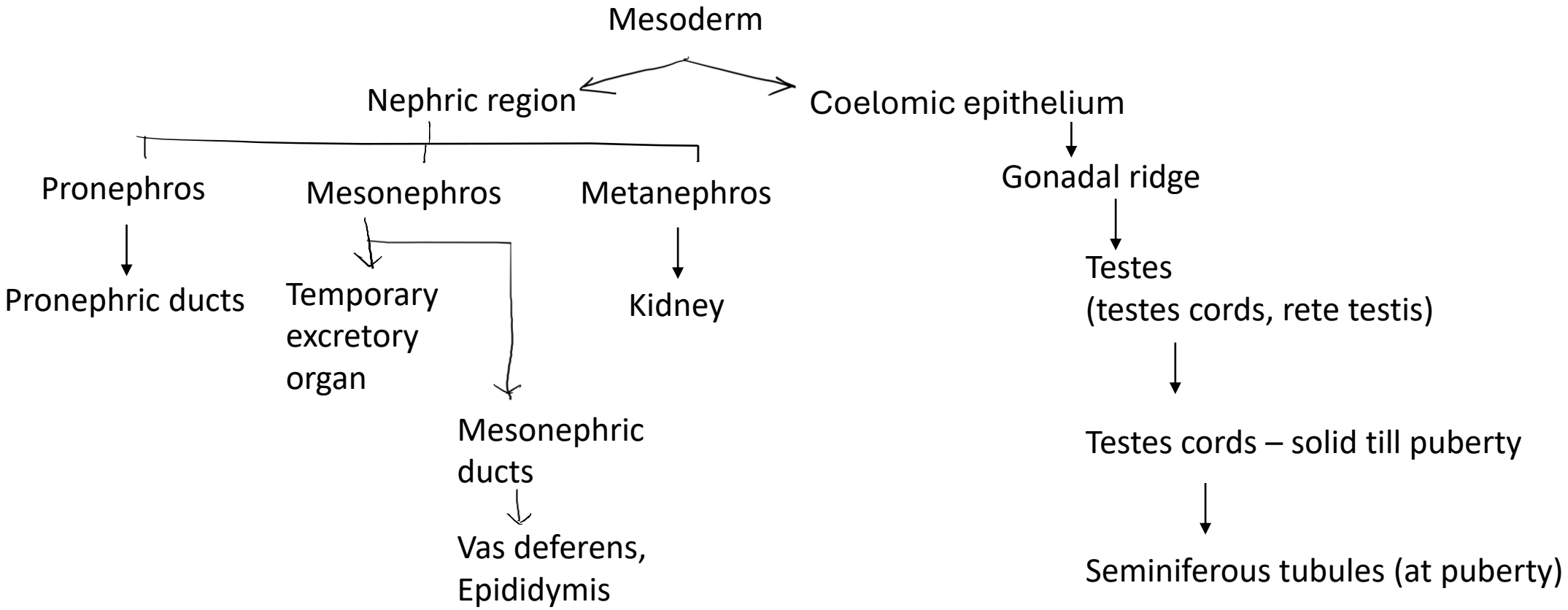
In the absence of testosterone and AMH, the **Müllerian ducts** develop into:

1. Oviducts (Fallopian tubes)
2. Uterus
3. Upper portion of the vagina.

The **Wolffian ducts** regress due to lack of androgens.

EMBRYOLOGY

- UGD develops from mesodermal tissue



*Remnants in adult – uterus masculinis, appendix testes (from paramesonephric ducts), paraepididymis (mesonephric duct)

Undifferentiated Genital Structures in the Embryo and Adult Male Counterparts

Embryonic Structure	Adult Male Counterpart
Gonad	Testis
Mesentery	Mesorchium (connective tissue)
Gubernaculum	Ligamentum Testis
Paramesonephric Duct (Müllerian Duct)	Appendix Testis, Uterus Masculinus
Mesonephric Duct (Wolffian Duct)	Epididymis, Vas Deferens, Ampulla
Genital Tubercle	Penis
Genital Folds	Penile Urethra
Genital Swellings	Scrotum
Urogenital sinus	Bulbourethral glands

•The gubernaculum, a fibrous cord, plays a crucial role in guiding the descent of the testes. As it grows, it pulls the testes down towards the scrotal swellings.

•At the same time, an **elongated diverticulum of peritoneum called the processus vaginalis forms**, which helps create the **spermatic cord** and allows for the **eventual formation of the tunica vaginalis** around each testis.

TESTICULAR DESCENT

- Abdominal cavity -> Inguinal canal -> scrotum
- Important for testicular descent
  - Gubernaculum (ligament)
  - Androgens from foetal testicles
  - Intra-abdominal pressure

- Cryptorchidism – Failure of one or both testes to descend into scrotum – retained testes

TESTICULAR DESCENT

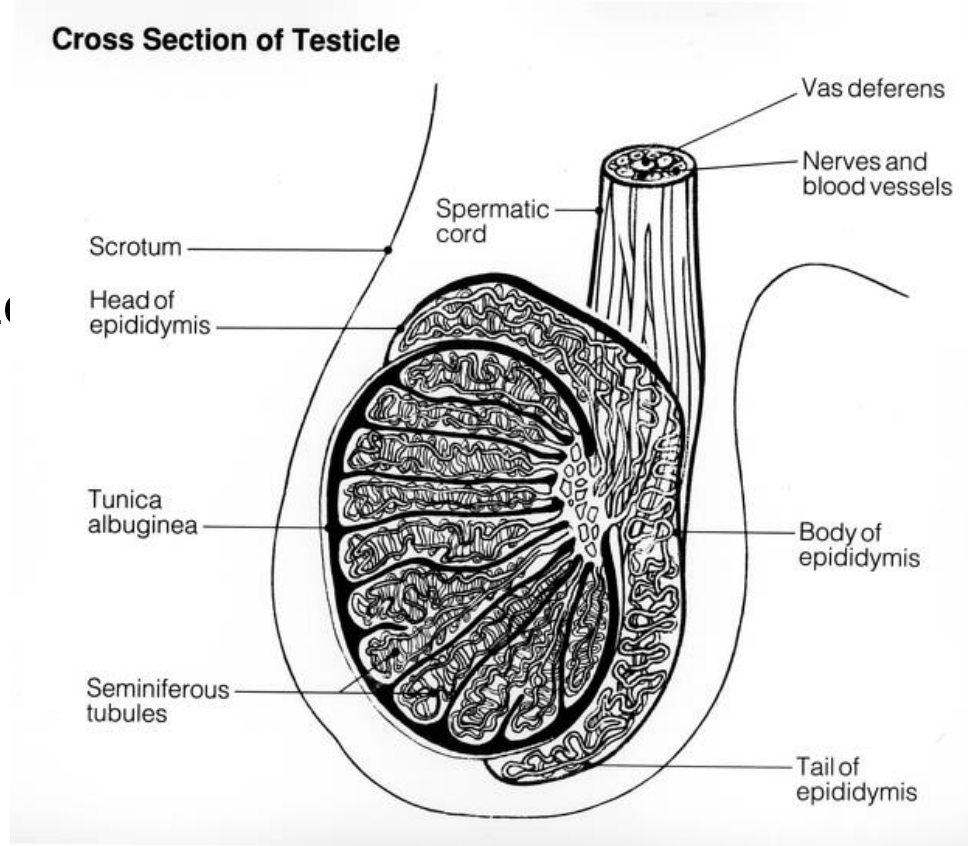
- Time of descent:
  - Stallion: 9-11 months of gestation
  - Cattle: 3.5-4 months of gestation
  - Sheep/Goats: 2.5-3 months of gestation
  - Swine: 3 months of gestation
  - Dogs: 5 days after birth

SCROTUM

- Bilobed sac that encloses the testes
- Location: Between the thighs
  - * exception: Boar and Tom cat – caudal to the thighs
- **Scrotal ligament** – attaches testes and epididymis to scrotum
  - *Absent in bulls
- Function:
  - Thermoregulation for testes to aid in sperm production
  - Spermatogenesis needs 2-7°C (3.5 °C) temperature less than body temperature
  - Flaccid and elongated in hot climate (dartos and cremastor muscles relax)
  - Contracted and wrinkled in cold climate

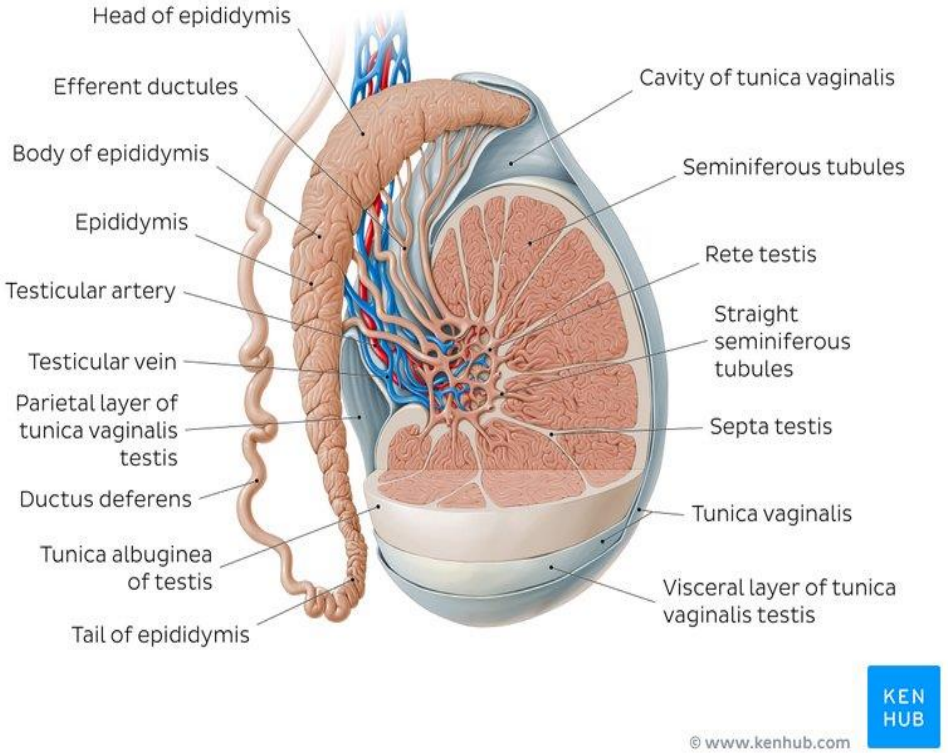
TESTES

- A.k.a. – orchium
- Structure:
  - Paired, oval-shaped glands – extra abdominally located
    - **Exception:** whale, seal, dolphin, elephant, rhinoceros – intra-abdominal
  - Separated by a septum formed by dartos muscle
  - **Spermatic cord:**
    - Spermatic artery, vein (Pampiniform plexus)
    - Spermatic nerve
    - Vas deferens
    - Cremaster muscle
    - Lymphatic vessels
    - Tunica vaginalis propria



TESTES

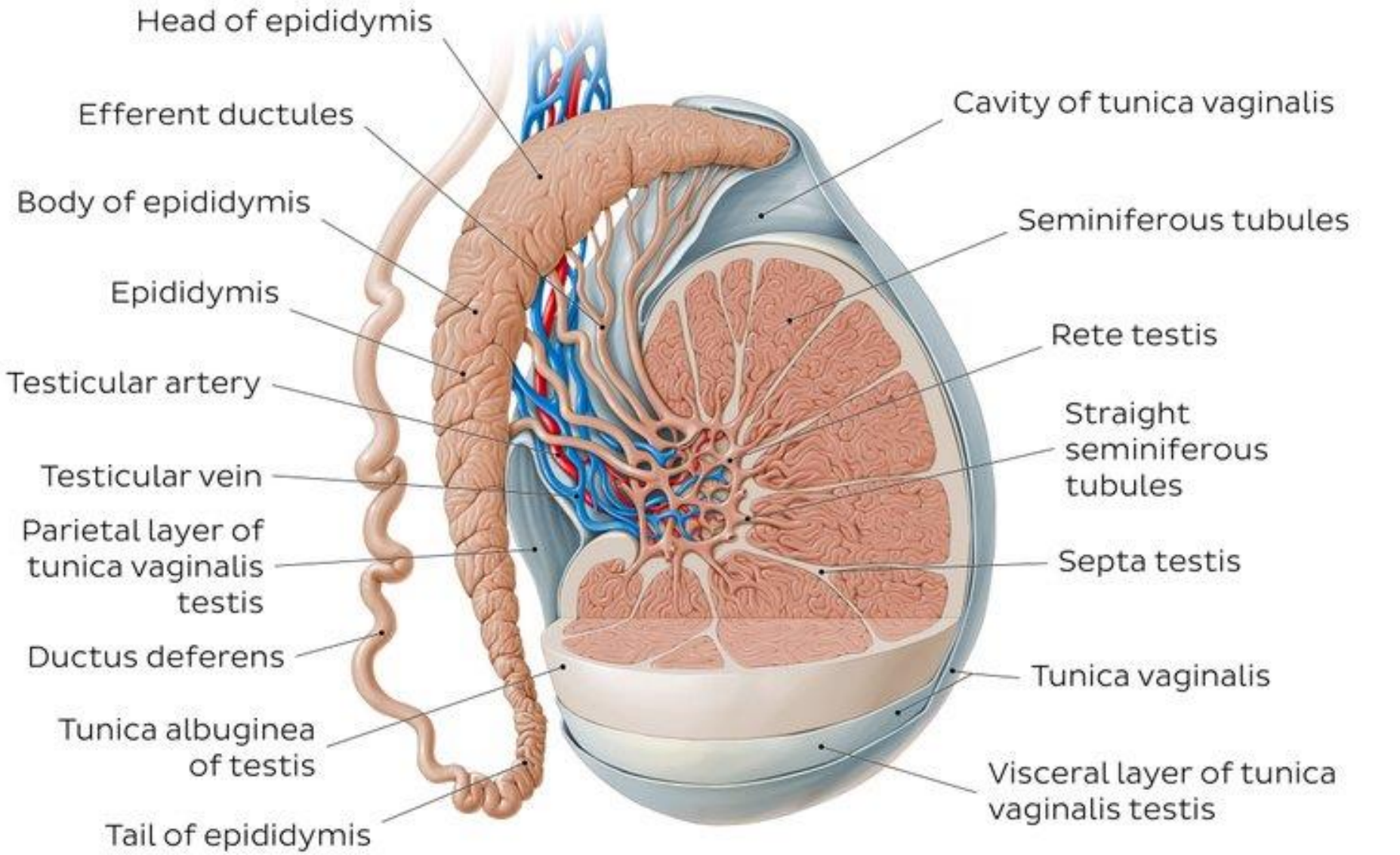
- **Internal structure:**
  - Testicular capsule:
    - Tunica vaginalis propria
    - Tunica albuginea



  - Testicular Parenchyma:
    - Seminiferous tubules (site of sperm production)
    - Interstitial cells of Leydig (Secrete **testosterone**)

Sertoli cells (**nurse cells)**

- Capillaries, lymphatic vessels, connective tissue



Testes

Functions of testes:

- Spermatogenesis
- Testosterone production
- Sperm nourishment
- Blood testes barrier

Testicular ligaments:

- Fetal ligament of gubernaculum
- Testicular mesentry
- Testicular appendix

1. Fetal Ligament of Gubernaculum

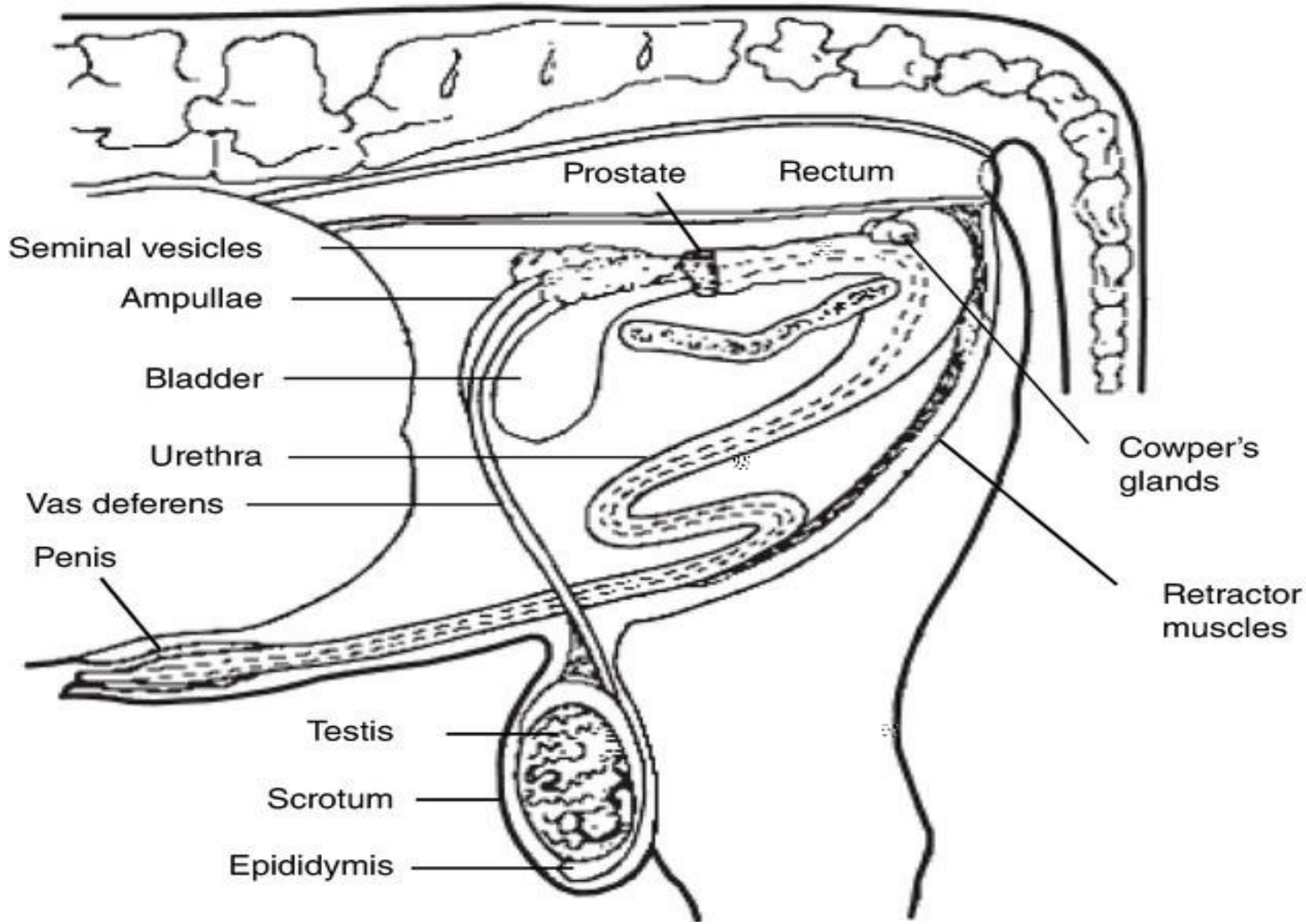
The gubernaculum is a fibrous cord that connects the developing testes to the scrotum. In fetal development, it guides the descent of the testes from their original position in the abdomen to the scrotum. The fetal ligament of gubernaculum becomes a **remnant in adult males**, aiding in maintaining the position of the testes within the scrotum.

2. Testicular Mesentery

The testicular mesentery refers to a fold of peritoneum that attaches the testes to the posterior abdominal wall. It contains blood vessels, nerves, and lymphatics that supply the testes. This structure is crucial for providing the necessary support **and vascular supply** during development.

3. Testicular Appendix

The testicular appendix, also known as the "appendix testis," is a small remnant of embryonic tissue located at the **upper pole of each testis**. It is considered a **vestigial structure** and may vary in size among individuals. While generally non-functional, it can sometimes **be involved in pathological conditions.**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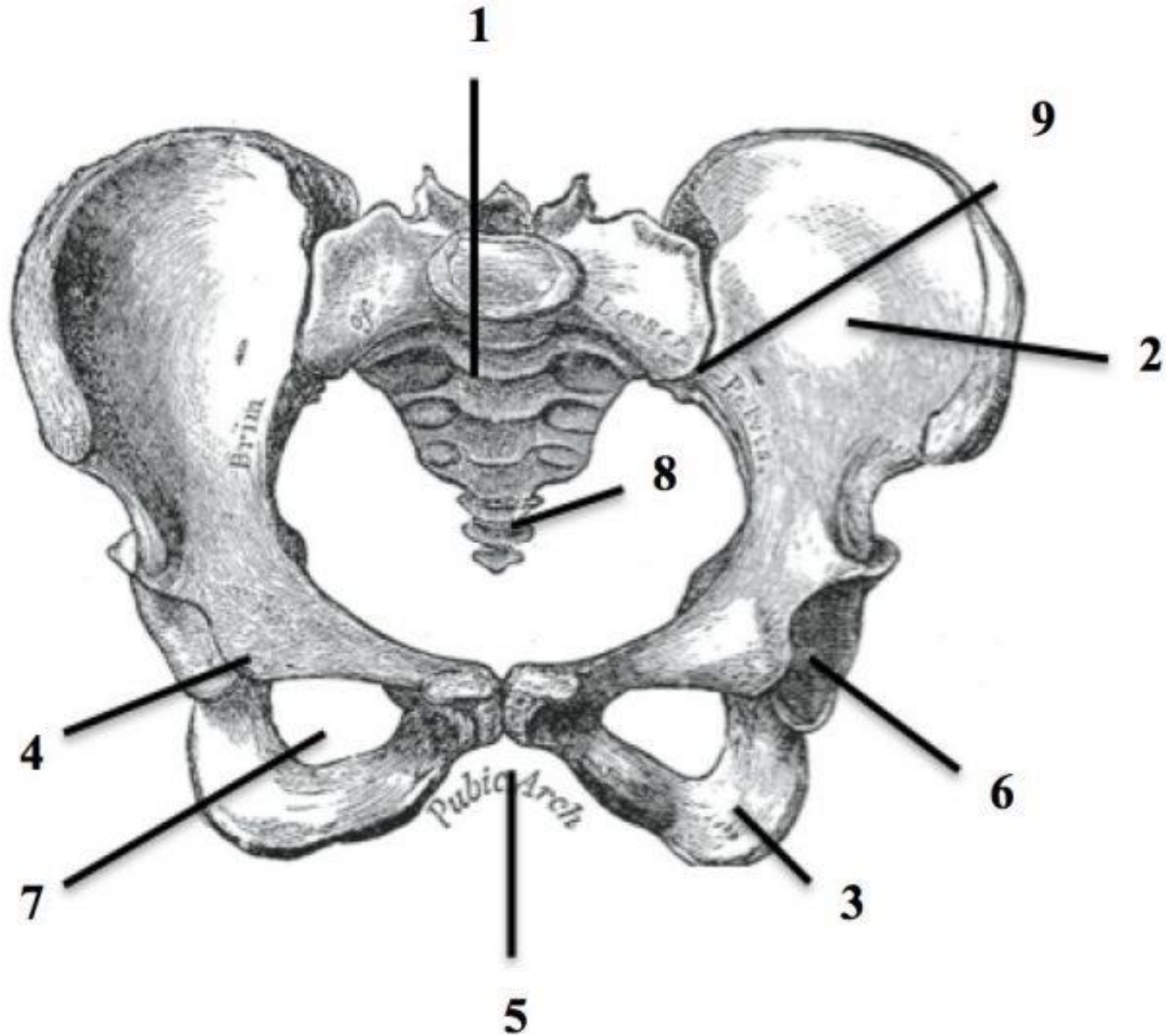
The bony pelvis.

1. Sacrum
2. Ilium
3. Ischium
4. Pubic bone
5. Pubic symphysis
6. Acetabulum
7. Obturator foramen
8. Coccyx



ACCESSORY SEX GLANDS

1. Seminal Vesicle

- Species specific points:
- Boars – volume of ejaculated semen is highest
- Stallion – Seminal vesicle is bladder-like with a large central dilatation
- Dog and Cat – Seminal vesicle is absent

ACCESSORY SEX GLANDS

1. Seminal Vesicle

- Biochemical secretions:
  - Fructose
  - Citric acid
- Vesicular fluid secretion:
  - Main source of liquid part of ejaculate
  - Volume of semen is proportional to quantity of vesicular secretion

ACCESSORY SEX GLANDS

2. Prostate Gland

- Location: Floor of pelvis, around neck of urinary bladder
- Adds secretion to semen via ducts opening in the pelvic urethra
- Secretion : Prostatic fluid
- More serous than mucous
- Function of prostatic fluid:
  - Small quantities of important biochemicals (fructose)
  - **Alkaline pH Regulation:** The fluid secreted by the prostate is alkaline, which helps neutralize the acidity of the female reproductive tract. This creates a more favorable environment for sperm motility and longevity.
- Dogs: Prostate gland has 2 excretory ducts
  - Size of prostate increases with age (enlarged in older dogs)

ACCESSORY SEX GLANDS

3. Cowper's gland/Bulbourethral gland

- Paired glands
- Shape: Ovoid/walnut
- Absent in dogs
- **Boar**: Large, dense, thick, cylindrical gland

Cowper's gland/Bulbourethral gland

- Functions:
  - Pre-ejaculatory secretion
  - Cleans urethral passage
  - Lubricates urethral passage (male) and vagina (female)
  - Maintains optimum pH in urethral passage

URETHRA

Function: Common passage for urine excretion and semen transportation.

Enclosed by **Wilson's muscle** (urethral muscle) for ejaculation and **micturition.**

Bulb of Urethra: Situated at the ischial arch, bending ventrally to the pelvis.

Penile Part: Runs inside the penis

PENIS

Male copulatory organ

Supported by penile fascia and skin

Enclosed in a sheath called **prepuce**

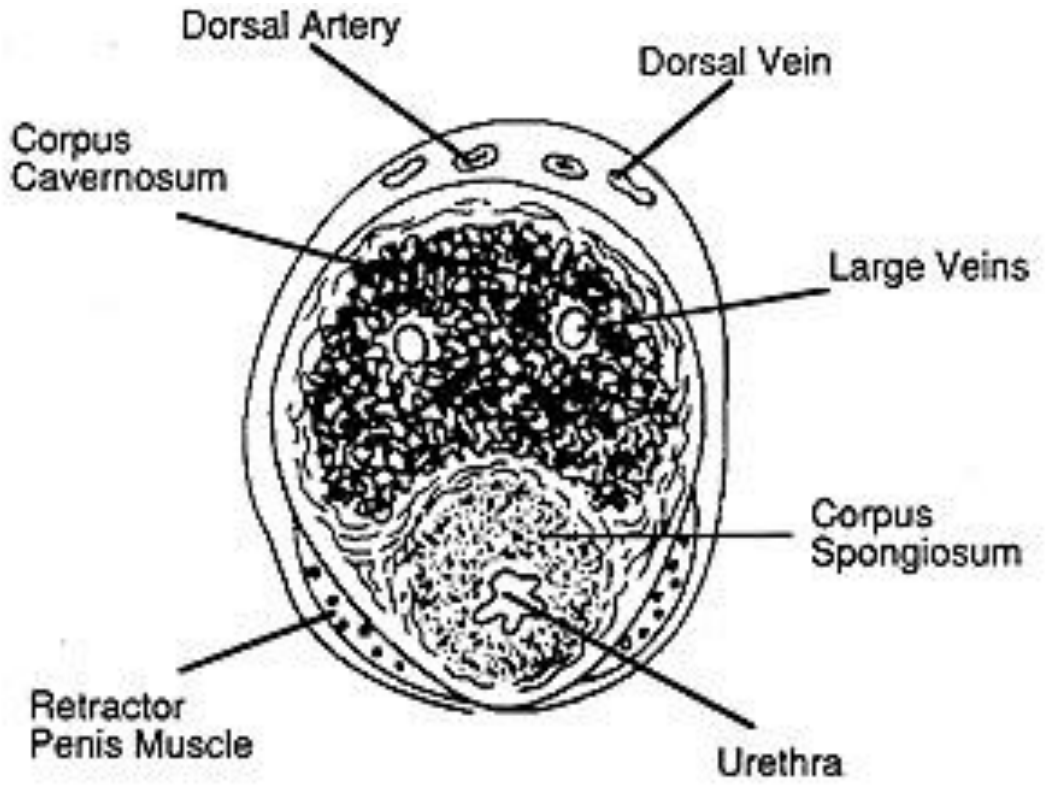
Glans penis – freely moving terminal portion inside the prepuce

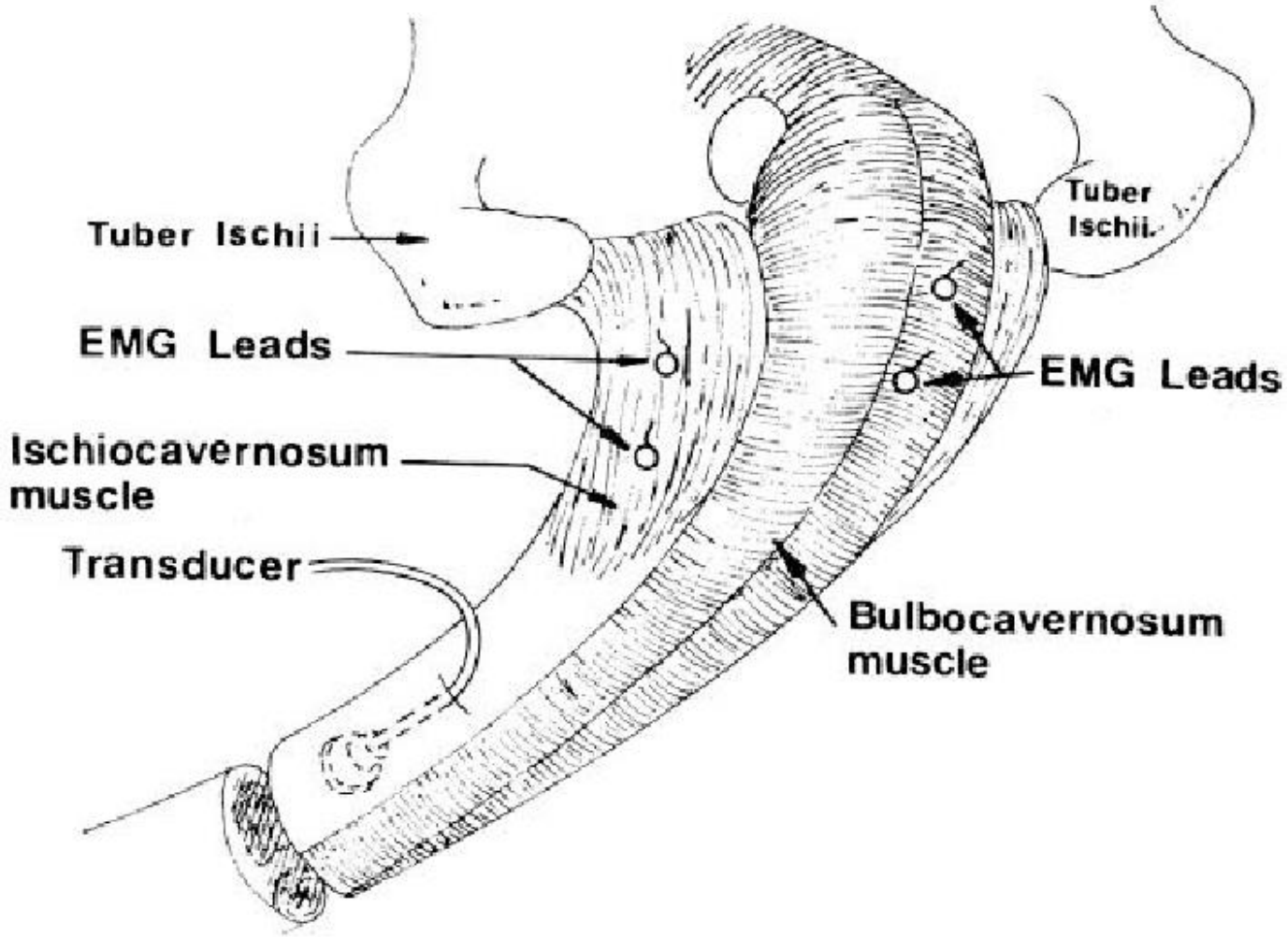
Parts of the penis:

1. Phallus Root – attached to ischial bone and ischio-cavernosus muscle
2. Phallus Body – formed by corpus cavernosum and corpus spongiosum
3. Glans penis

Muscles of the penis:

1. Corpus cavernosum penis
2. Corpus spongiosum
3. Retractor Penis
4. Urethral muscle
5. Ischio-cavernosus
6. Bulbo-cavernous muscle





Bulbo-cavernous muscle & Ischio-cavernosus

PENIS

Species wise differences:

- Bulls, Rams – have sigmoid flexure
- Stallion – large amount of erectile tissue
- **Boar** – corkscrew penis
- Dogs **– Os penis present**
- **Tom cat – penile papillae** present, os penis (occasionally present)

Swine and ruminants urinate **inside the prepuce***

** **Extra preputial urination** (extend penis beyond sheath before urination)*
*– **Horses, dogs, cats***