VET-114
Animal Anatomy and Physiology 2

Webinar – Chapter 17

Oogenesis; Spermatogenesis

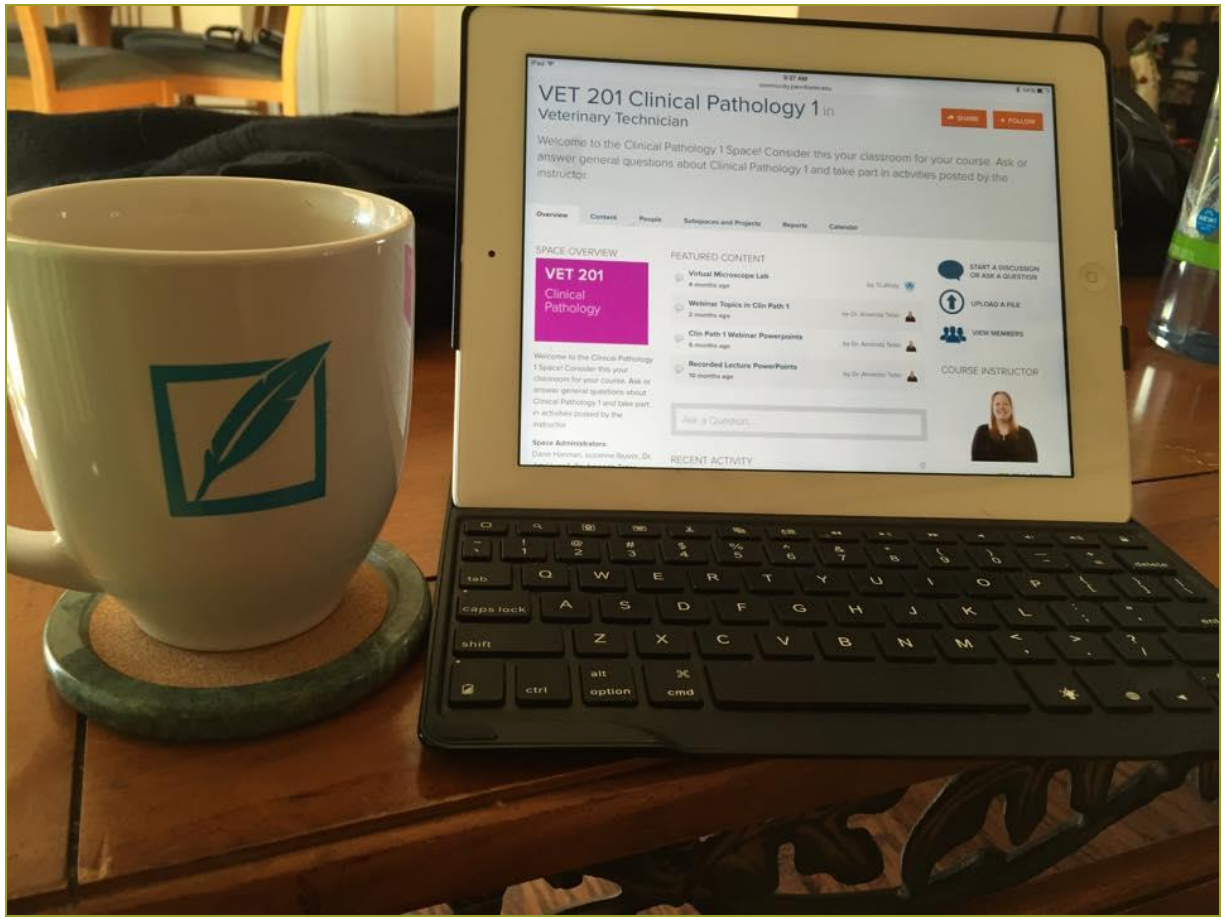
Male Reproduction System

A Warm Welcome from My Faculty TEAM and Me!!! ☺

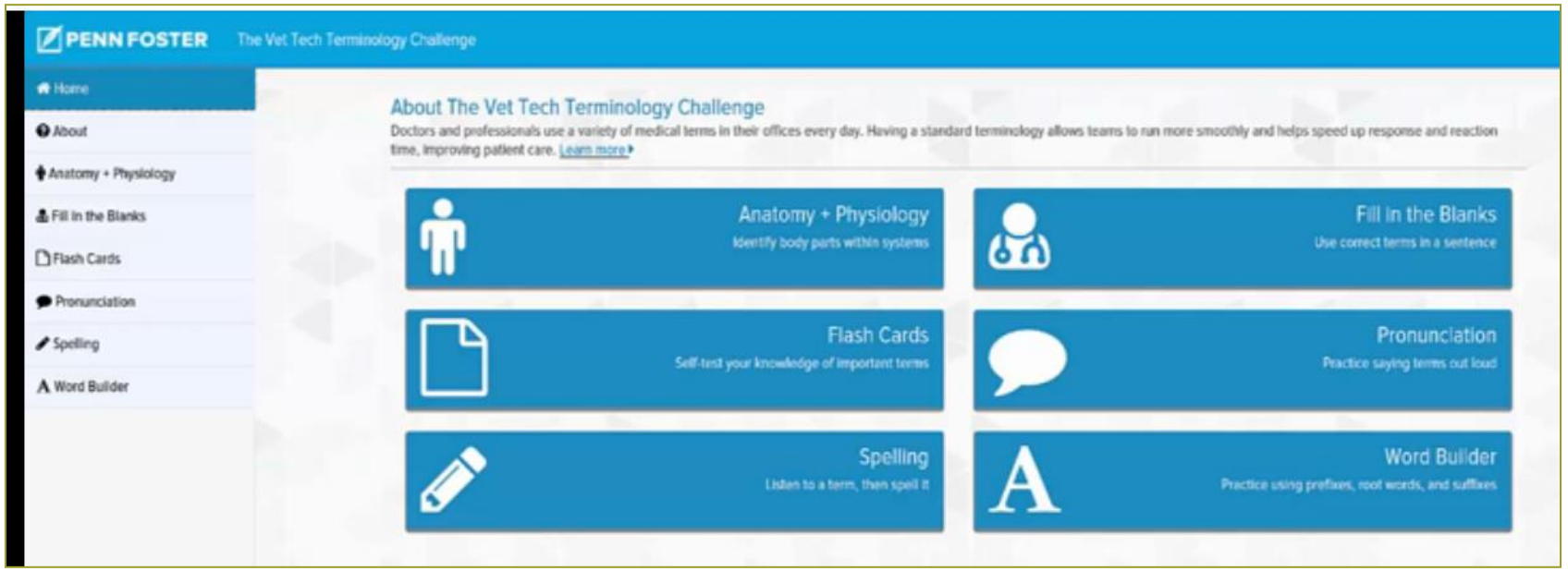
The Pledge of Allegiance

Tribute to Our Military Students and Their Spouses!

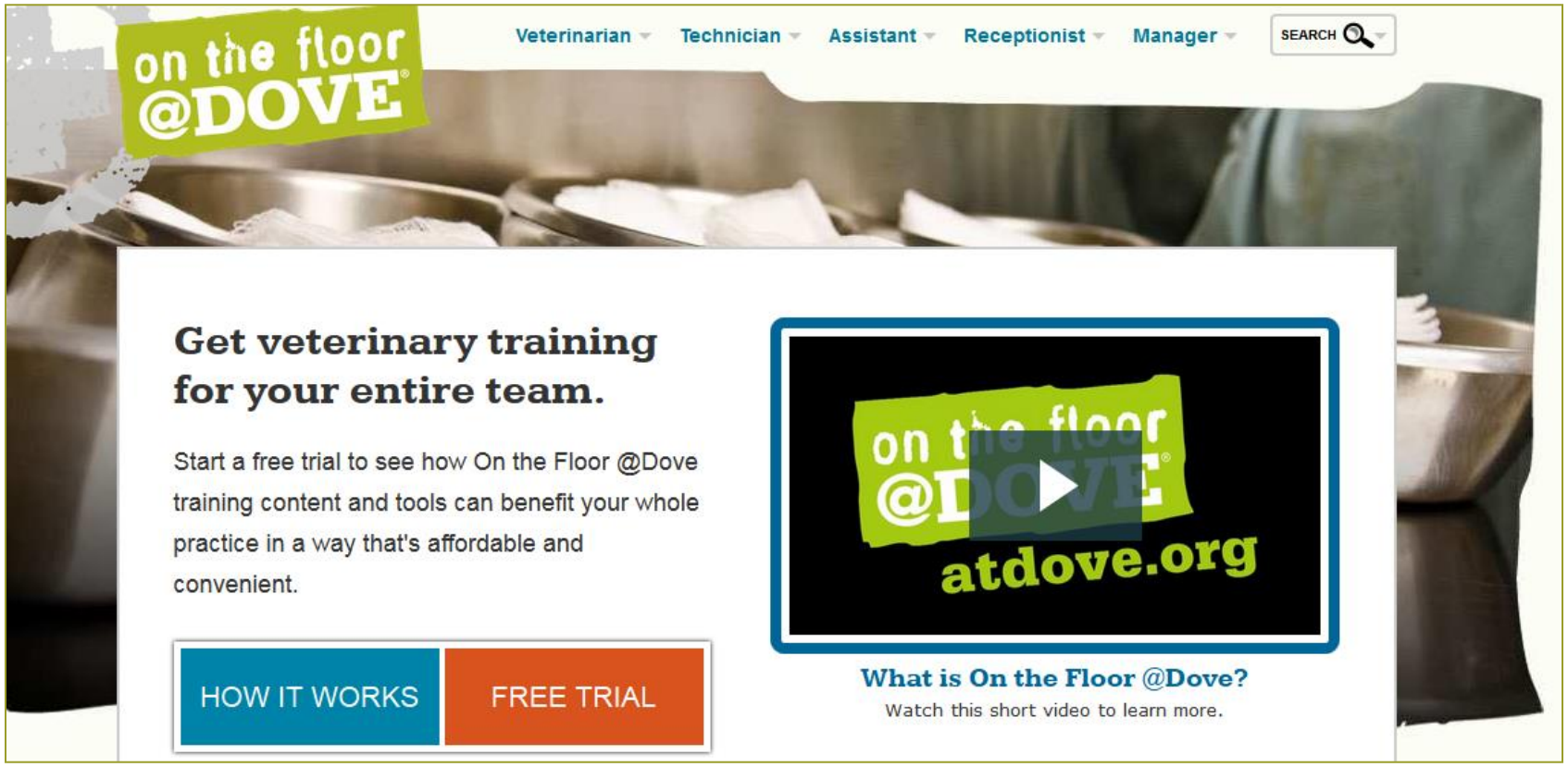
Are You Using the Course Spaces?



New “Medical Terminology Game”!



On the Floor at Dove!
https://www.atdove.org/welcome

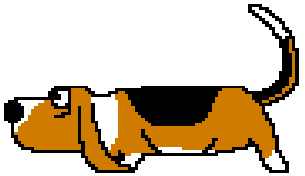


You Better Believe It! ☺

http://www.youtube.com/watch?v=jBTMfKTvhms&app=desktop

The Reproductive System

Chapter 17 – Pages 387-404



Putting Things in Perspective!

Animal Sex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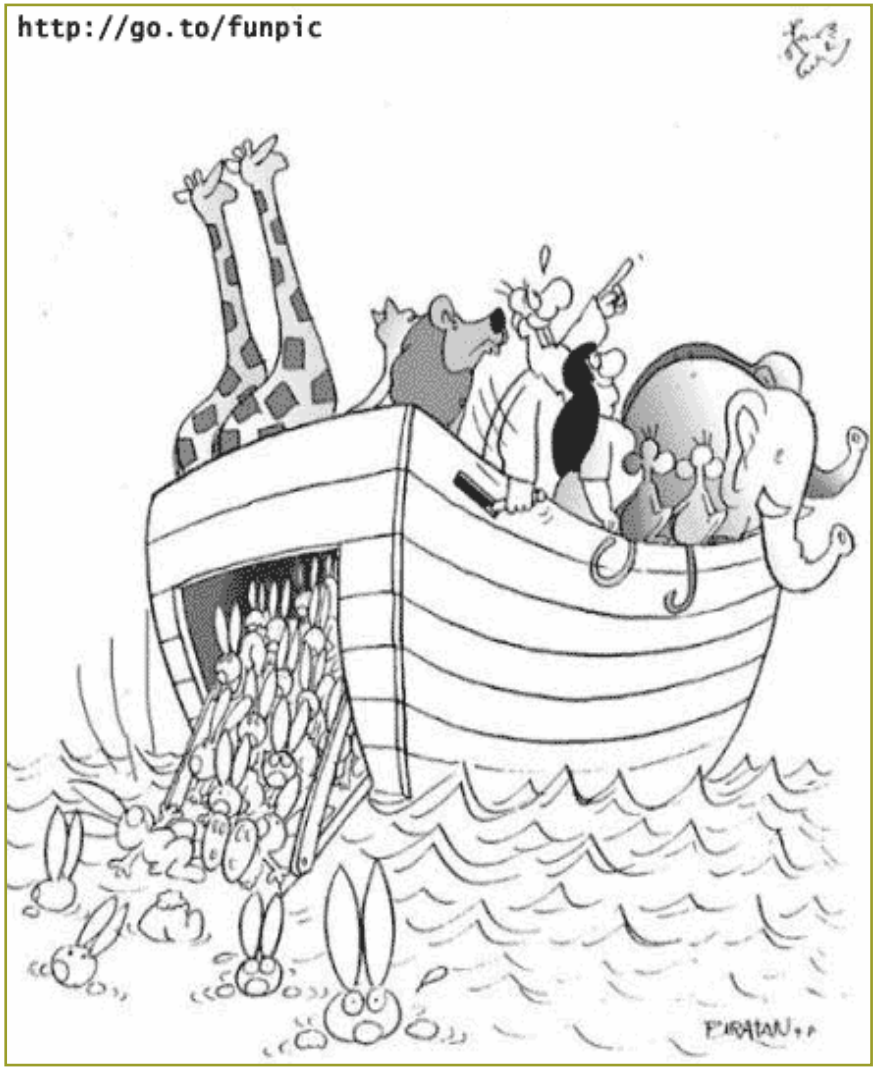
THE REAL REASON
PAVLOV'S DOG SALIVATED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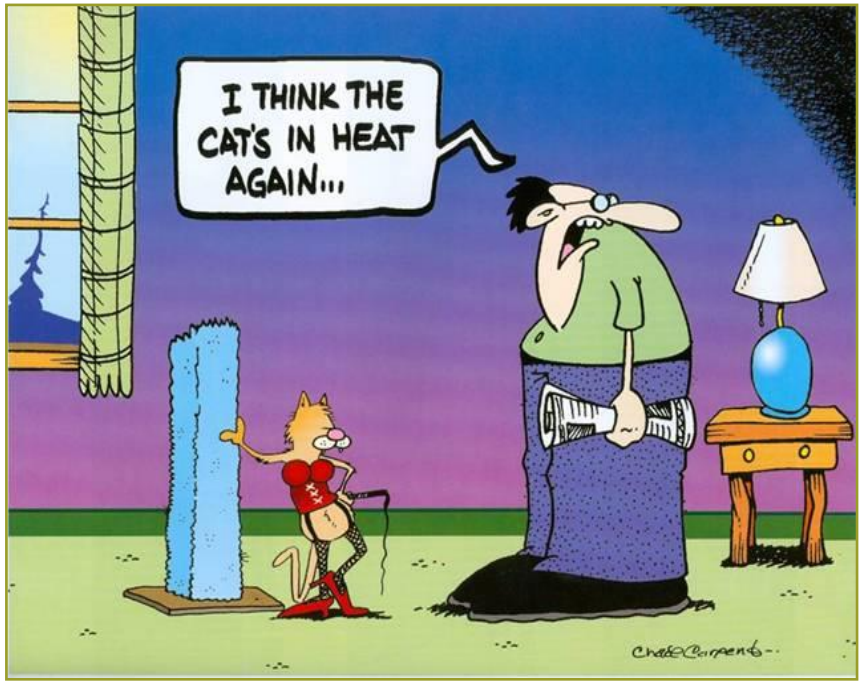
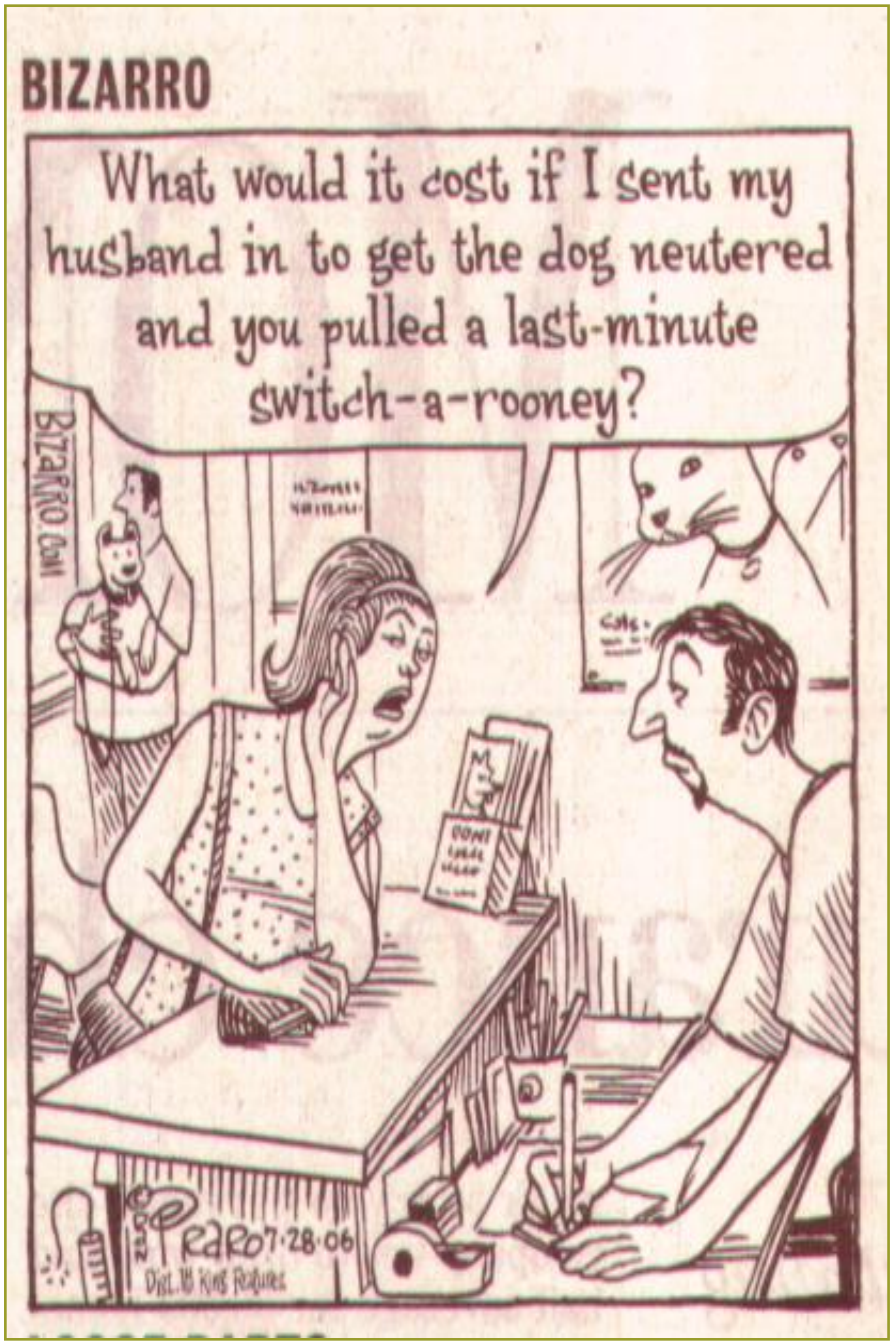
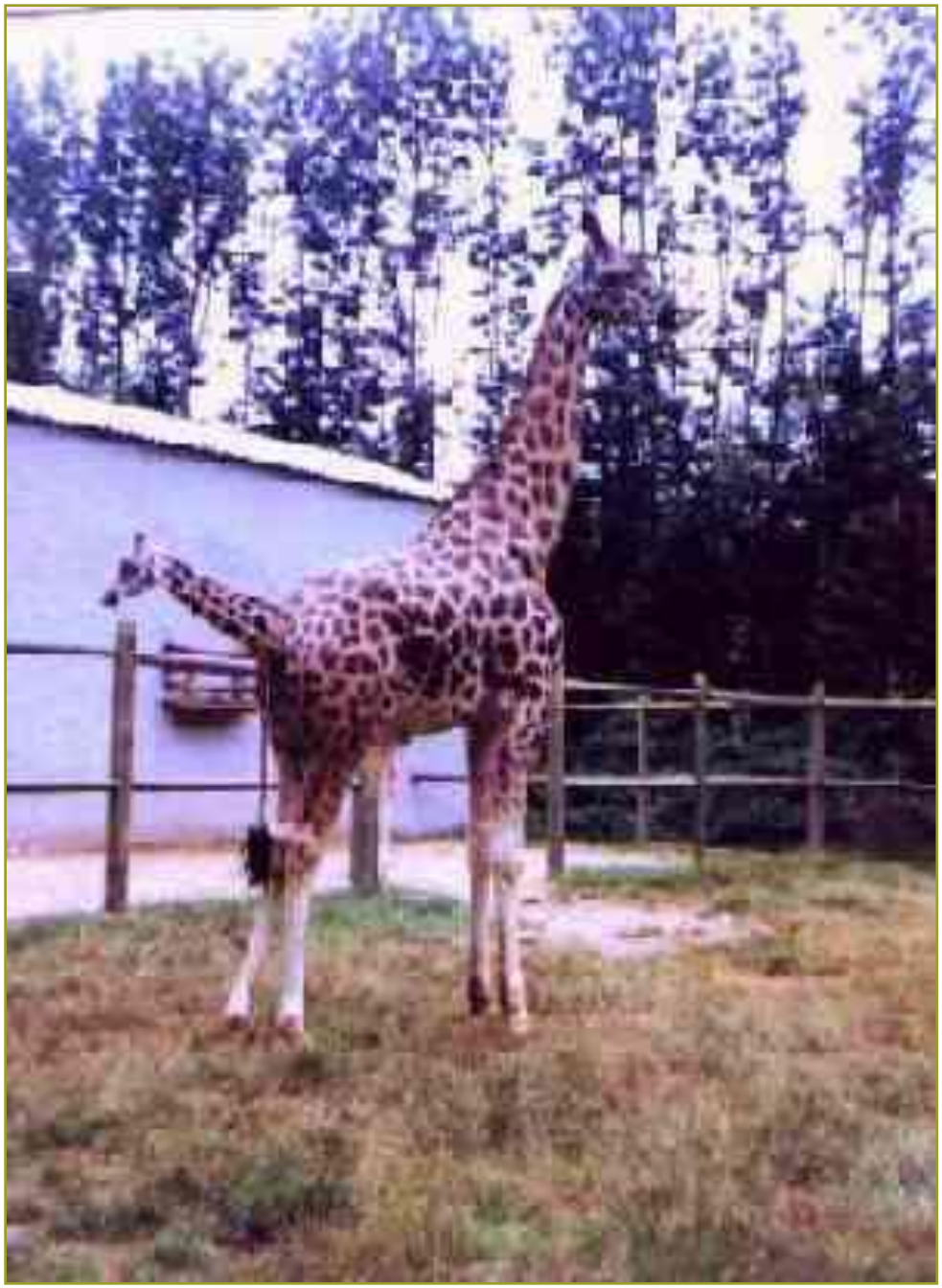

I THINK THE CAT'S IN HEAT AGAIN...


BIZARRO
What would it cost if I sent my husband in to get the dog neutered and you pulled a last-minute switch-a-rooney?
BIZARRO dot com
7·28·06
Dist. by King Features

Ever Happen to You? ☺

Anybody Know What She Is Doing?



Prolapsed Uterus?

OHE – Uterine Horns

Why Are There So Many Rabbits??? ☺

Overview – Sexual Reproduction

- **Survival of the species**
  - All other body systems are about the survival of the individual animal
- **Economic system** for agricultural species
  - Dairy
  - Beef
  - Equine (horse racing)
  - Pork
- **Sexual** reproduction
- **Asexual** reproduction

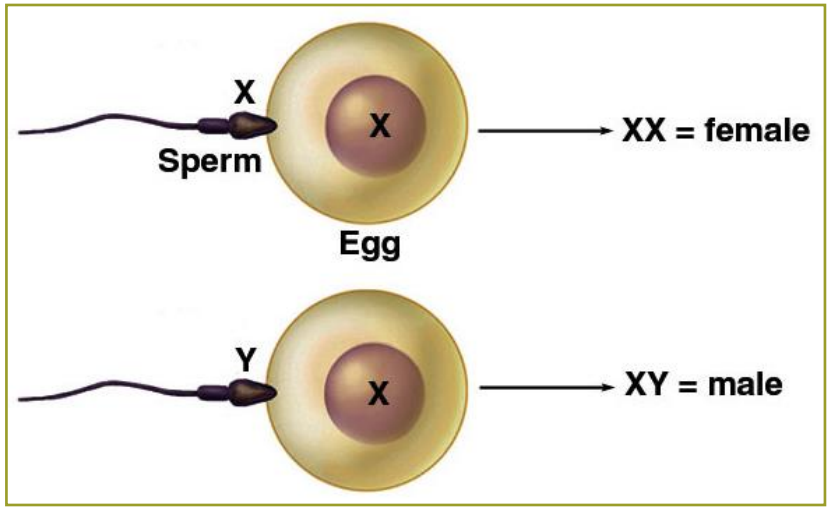
Why Sex?

- **Asexual reproduction** – massive numbers of "offspring" in short period of time, all organisms with same DNA
  - Bacteria, protozoans, cloning
- **Sexual reproduction** – fewer numbers of offspring, all organisms with different DNA
  - Increased genetic diversity (larger gene pool)
  - Increased survival of the species
  - Most multicellular organisms

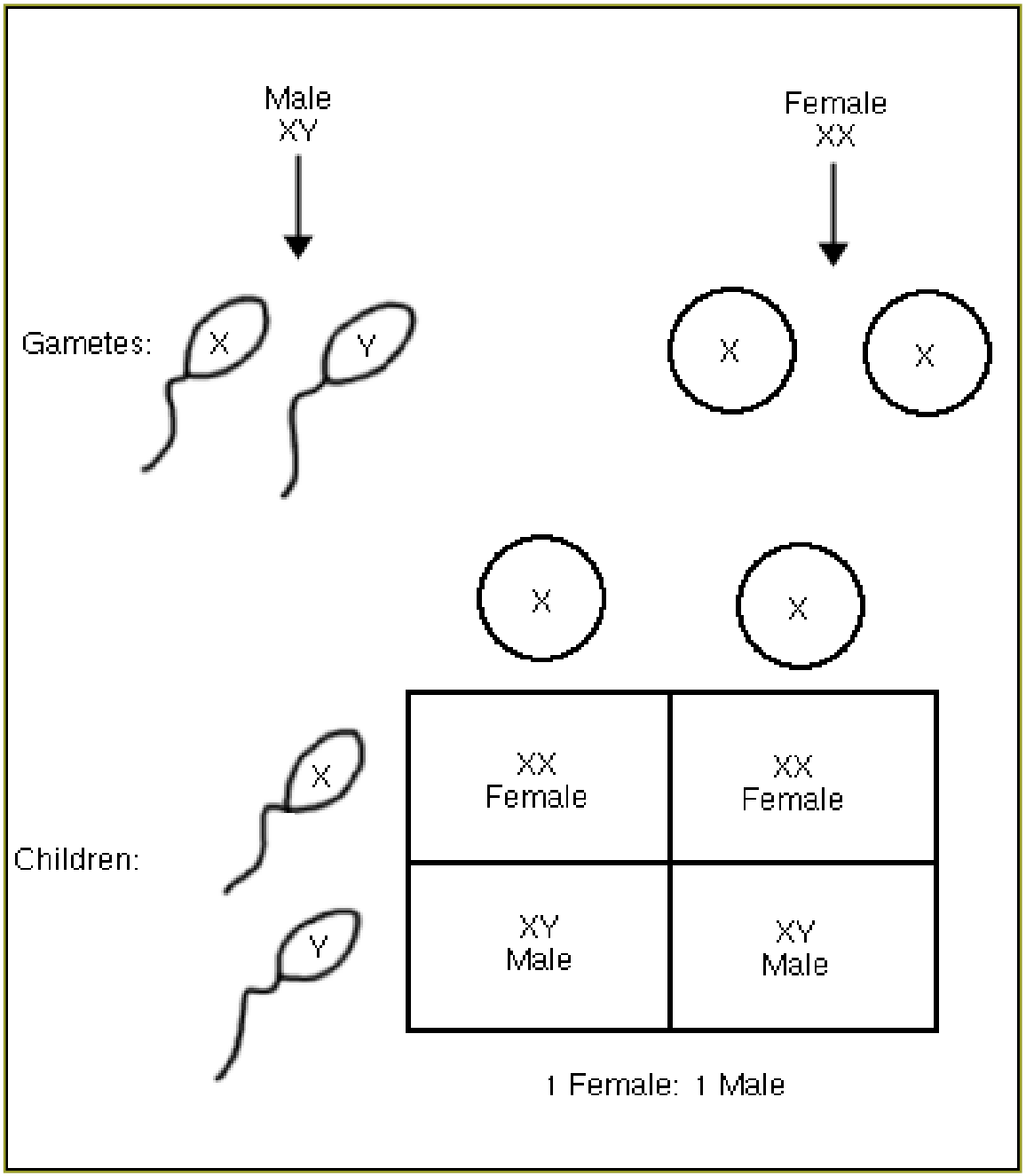
Cellular Reproduction

Table 17-1, Page 388

- **Mitosis** – **diploid** chromosome number (2n)
  - Production of all cells in body except gametes
- **Meiosis** – **haploid** chromosome number (n)
  - Production of gametes (sex cells)
- **Fertilization**
  - Sperm (n) + ovum (n) (2n)



The Genetics of Sex



Chromosomes

- Coiled masses of DNA in the nuclei of cells
- Each cell in an animal's body (except spermatozoa or ova) contains **paired, identical chromosomes**
- **Diploid chromosome number**
  - Total number of chromosomes in the nucleus of each body cell is the same (except for reproductive cells)
  - Always an even number – chromosomes occur in pairs.

Sex Chromosomes

- Designated as either "X" chromosomes or "Y" chromosomes
- If both of the sex chromosomes are X chromosomes (XX), the individual is genetically female
- If one is an X and the other is a Y (XY), the individual is genetically male

Mitosis

- Most body cells divide after the cell first makes a duplicate copy of its chromosomes
- Half the chromosomes go to one daughter cell and half go to the other
- Genetic makeup of the two daughter cells is exactly the same as each other and as the parent cell

Meiosis

- Chromosomes do not produce duplicate copies of themselves before daughter cells divide
- Half of the total chromosomes (one from each diploid chromosome pair and one sex chromosome) go to each daughter cell.
- Which chromosomes go to which daughter cell is entirely random

Haploid Chromosome Number

- **Reduction division** – total number of chromosomes in each of the daughter cells is reduced to half the number of the parent cell
- Ensures that the fertilized ovum from the union of spermatozoa and the ova has diploid number.
- **Haploid chromosome number** in the reproductive cells **results from meiosis**

Meiosis – Gamete Formation

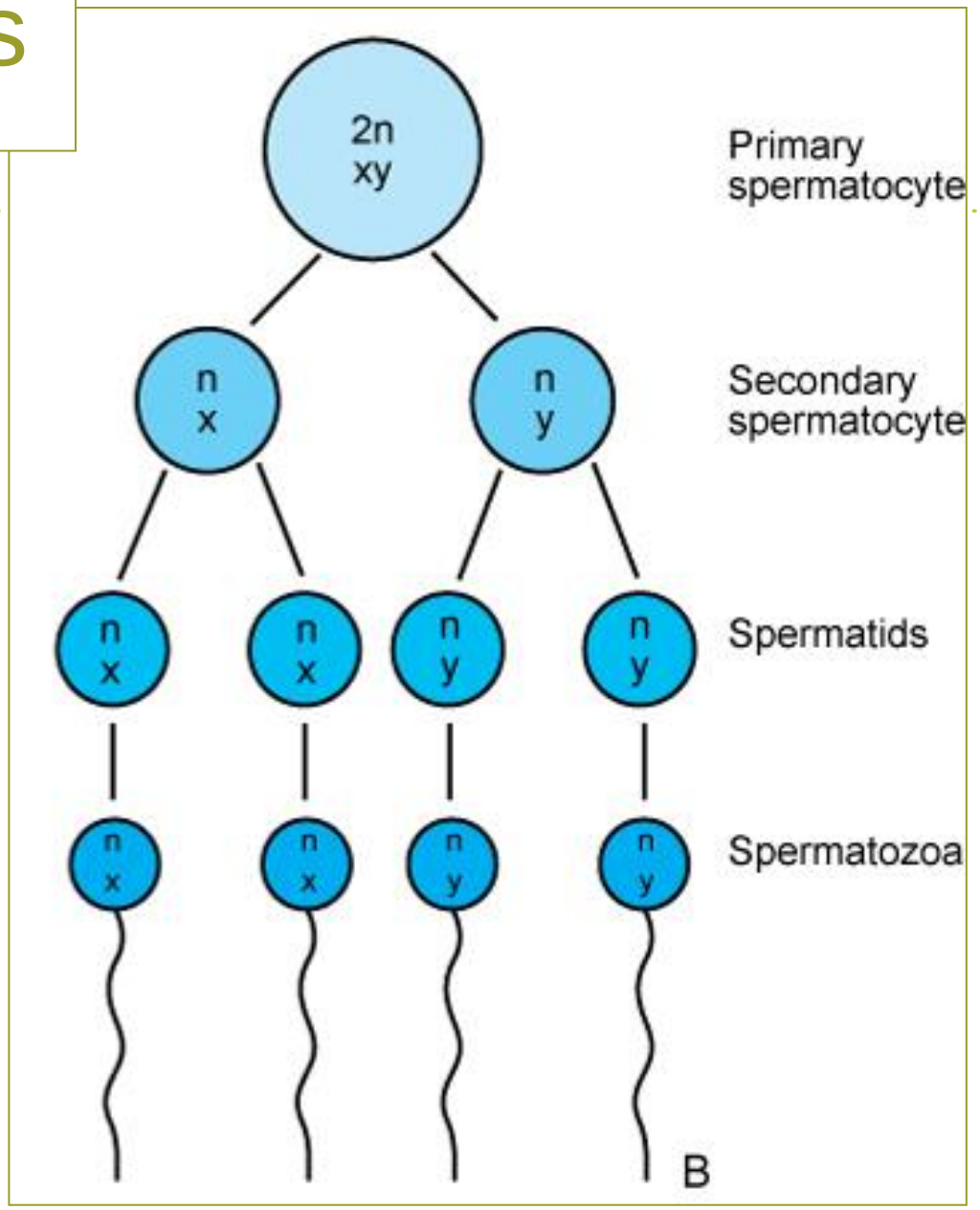
Figure 17-1, Page 390

- Diploid number → haploid number of chromosomes
- **Spermatogenesis** in male animal
  - 1 spermatogonium → 4 mature sperm
- **Oogenesis** in female animal
  - 1 oogonium → 1 mature egg (ovum) + 3 polar bodies

Spermatogenesis

Figure 17-1B, Page 390

- Production of male sex cells
- Occurs in **seminiferous tubules of testes**
- Produced continuously and in very large numbers



Spermatogenesis

- **Primary spermatocyte divides by meiosis** into secondary spermatocytes – **haploid number**
- The secondary spermatocytes **divide by mitosis** into four spermatids
- Spermatids grow tails and undergo other physical changes that convert them to spermatozoa.

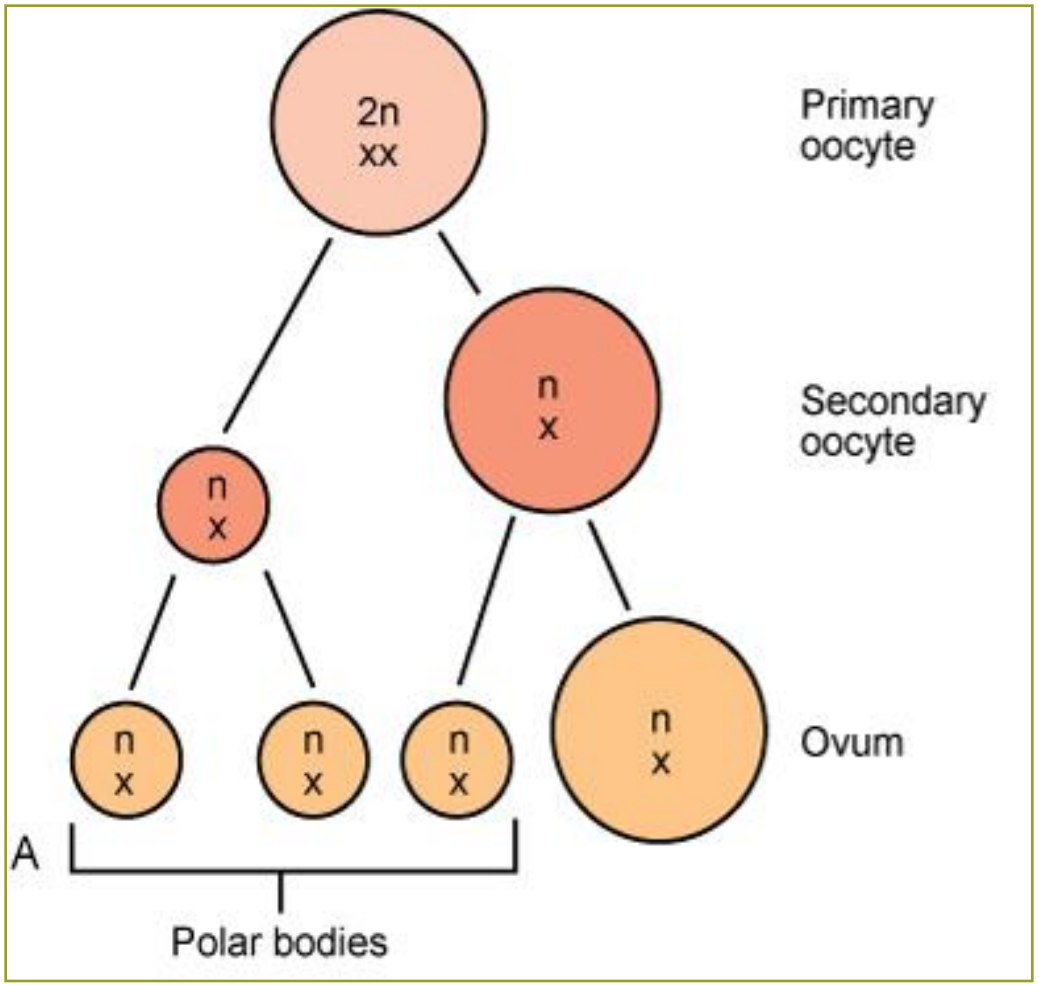
Spermatogenesis

- When the spermatozoa are fully developed, they detach and are carried to the **epididymis** for storage before ejaculation
- Half of the spermatozoa produced have an X sex chromosome, and half have a Y sex chromosome

Oogenesis

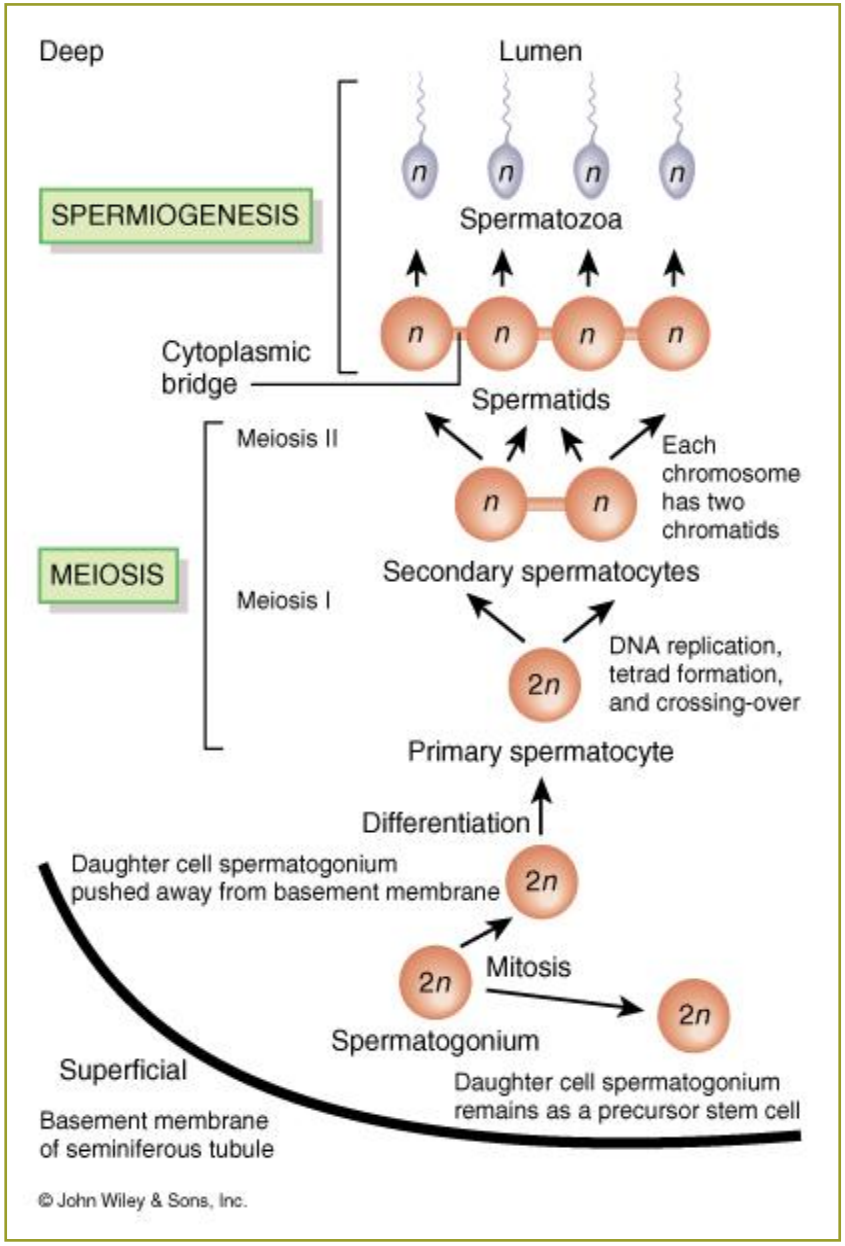
Figure 17-1A, Page 390

- Production of female sex cells
- Occurs in **ovarian follicles**
- Female has fixed number of primary oocytes at or soon after birth
- Oogenesis produces small numbers of ova at a time



Oogenesis

- Primary oocyte divides by meiosis into a large secondary oocyte and a small "polar body"
- Each has the haploid chromosome number
- Secondary oocyte and the first polar body divide by mitosis into an ovum and three polar bodies


Deep
Lumen
SPERMIOGENESIS
n
Spermatozoa
Cytoplasmic bridge
Spermatids
MEIOSIS
Meiosis II
Each chromosome has two chromatids
Secondary spermatocytes
Meiosis I
DNA replication, tetrad formation, and crossing-over
2n
Primary spermatocyte
Differentiation
Daughter cell spermatogonium pushed away from basement membrane
Mitosis
Spermatogonium
Superficial
Daughter cell spermatogonium remains as a precursor stem cell
Basement membrane of seminiferous tubule
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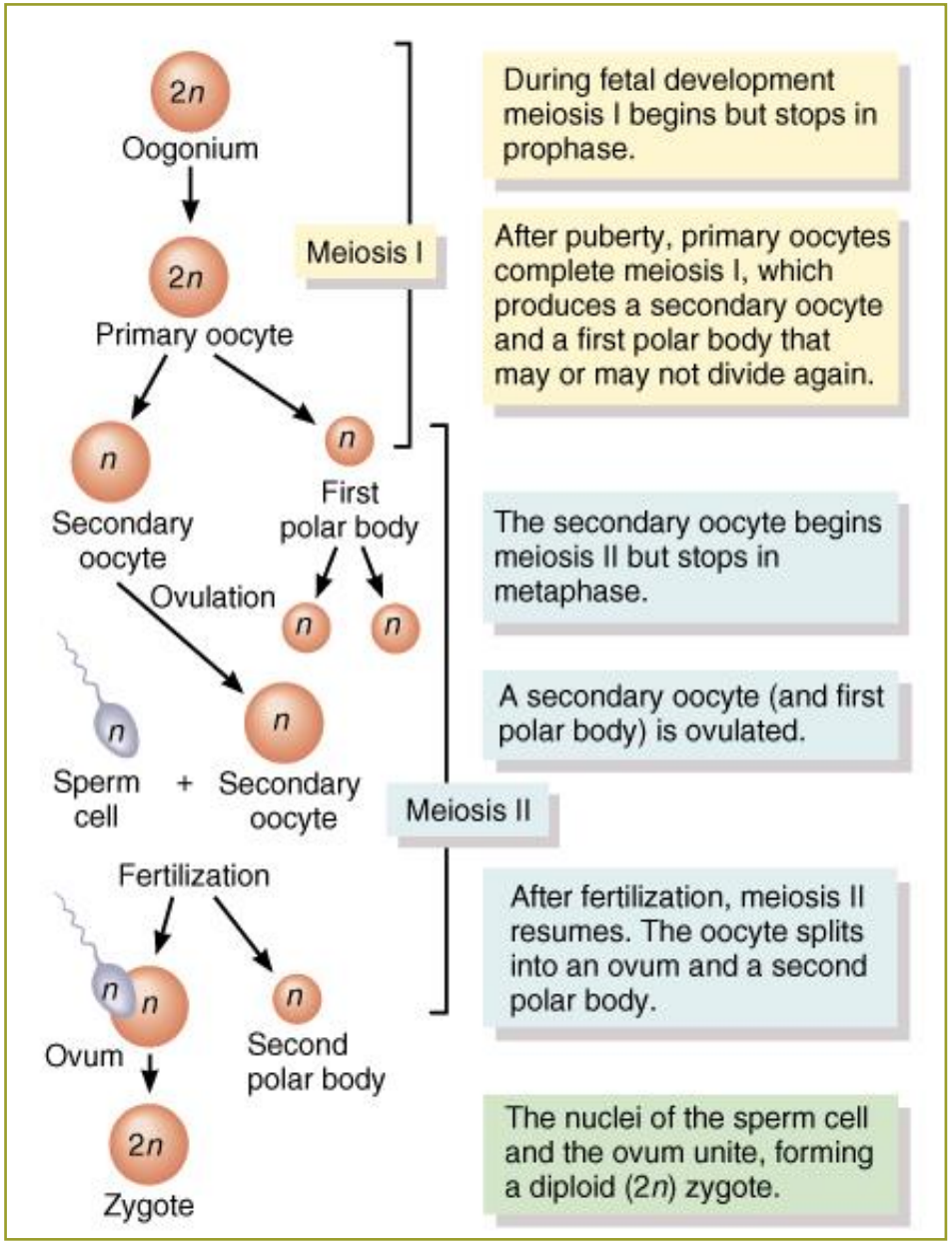
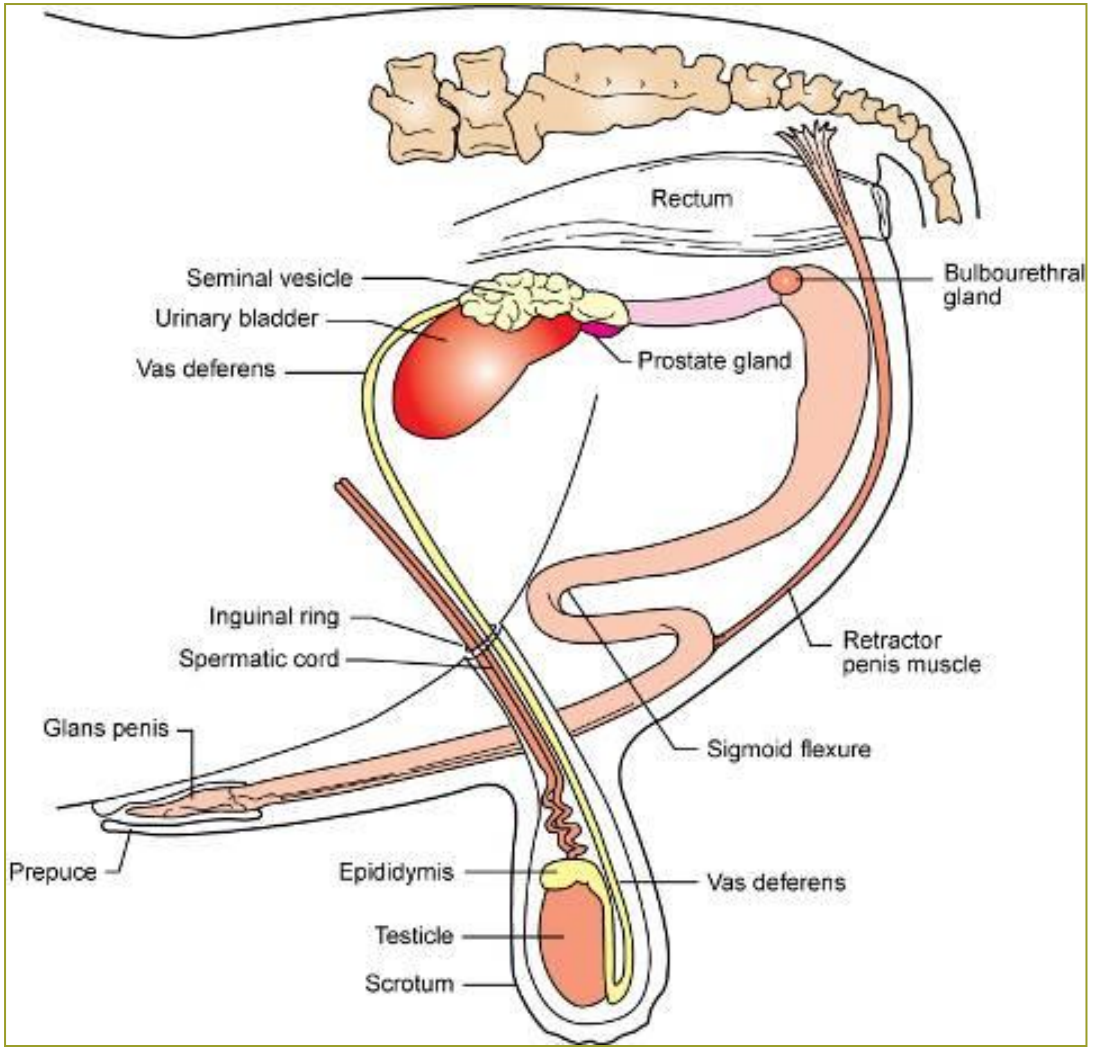

2n
Oogonium
Meiosis I
Primary oocyte
n
Secondary oocyte
First polar body
Ovulation
Sperm cell
+
Secondary oocyte
Meiosis II
Fertilization
Ovum
Second polar body
Zygote
During fetal development meiosis I begins but stops in prophase.
After puberty, primary oocytes complete meiosis I, which produces a secondary oocyte and a first polar body that may or may not divide again.
The secondary oocyte begins meiosis II but stops in metaphase.
A secondary oocyte (and first polar body) is ovulated.
After fertilization, meiosis II resumes. The oocyte splits into an ovum and a second polar body.
The nuclei of the sperm cell and the ovum unite, forming a diploid (2n) zygote.

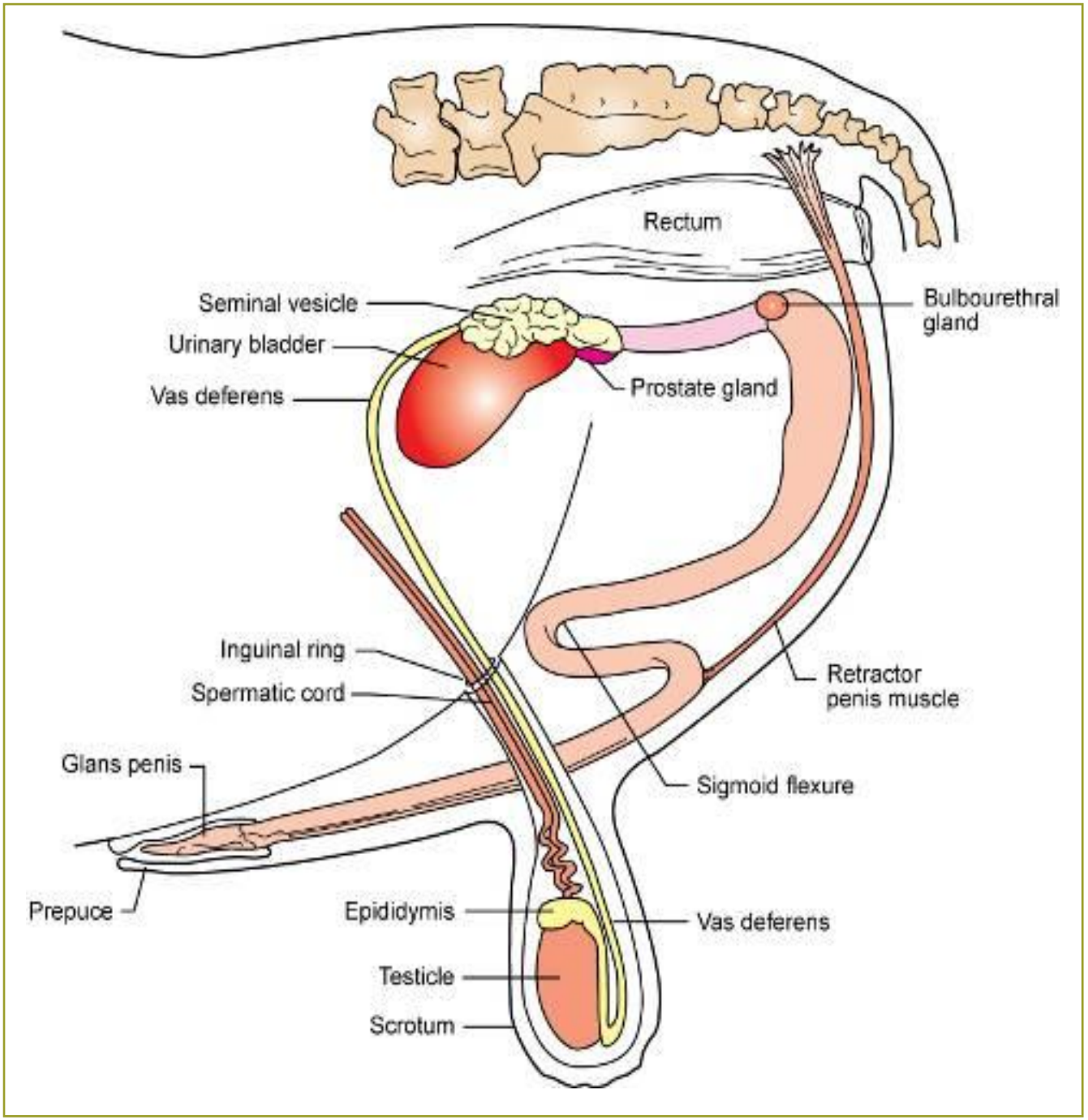
Male Reproductive System Functions

- Produces male sex hormones
- Develops spermatozoa
- Deliver the spermatozoa to the female system at the appropriate time

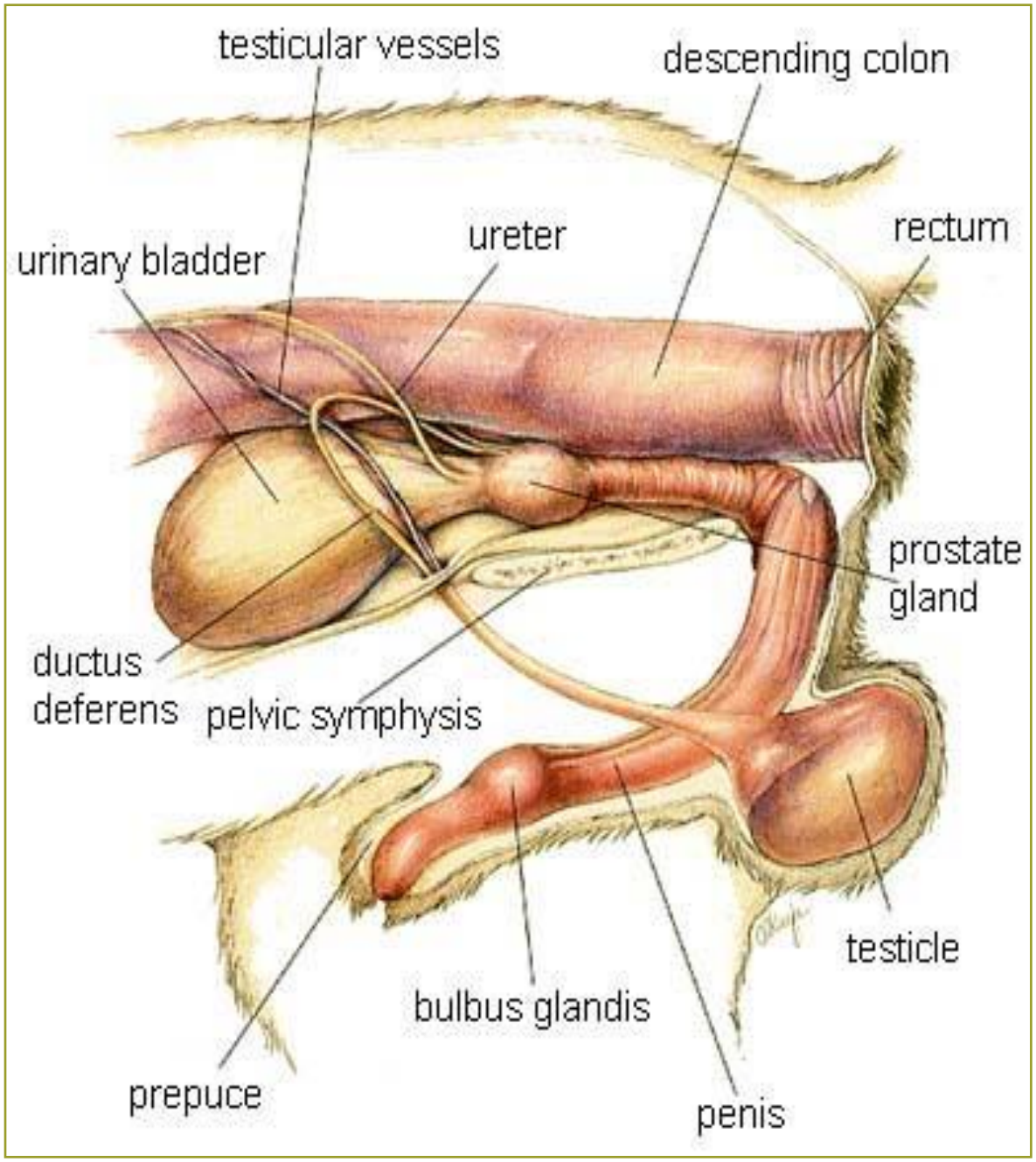


Trace a Sperm Cell (Bovine)

Figure 17-2, Page 391

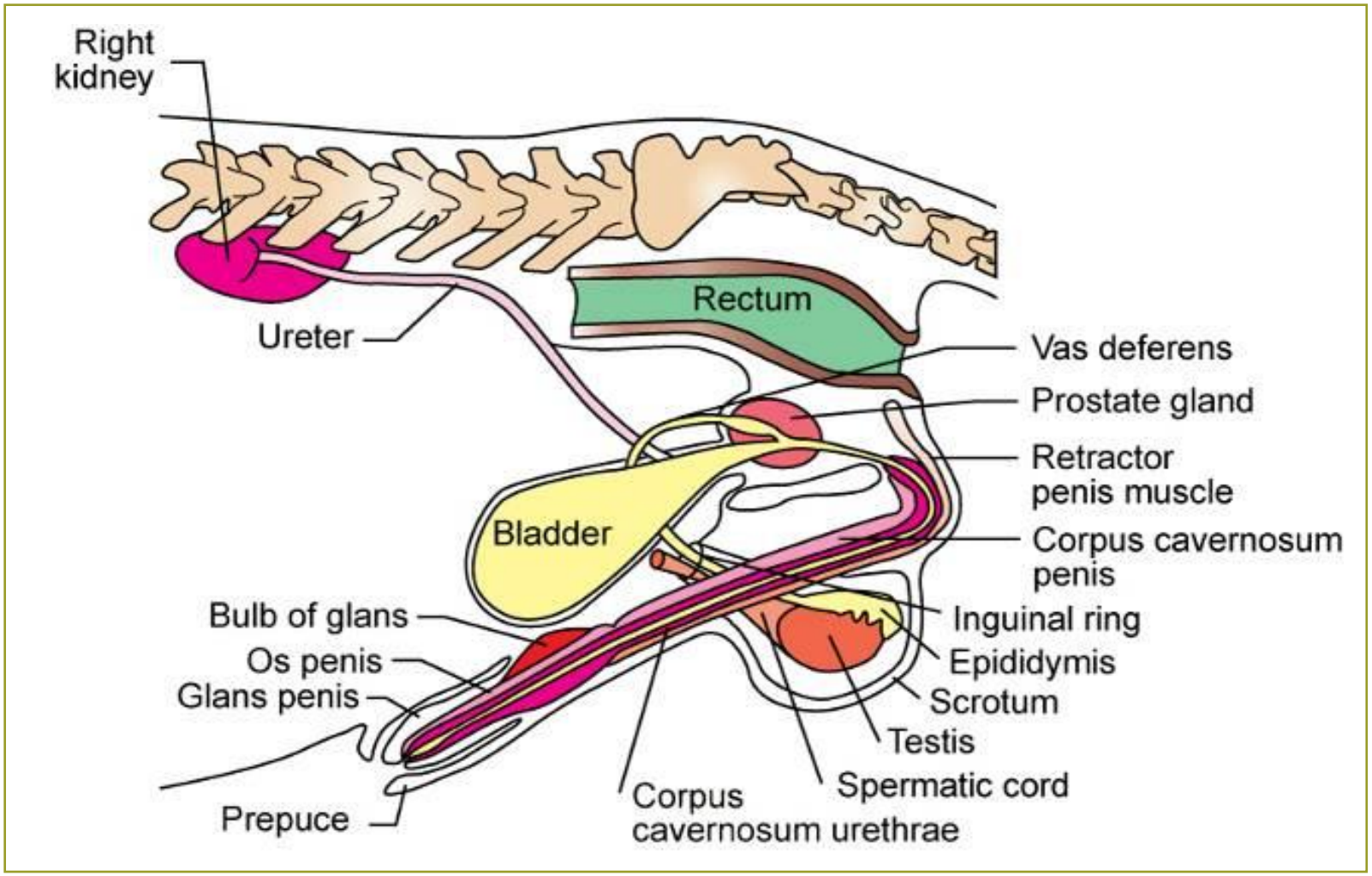


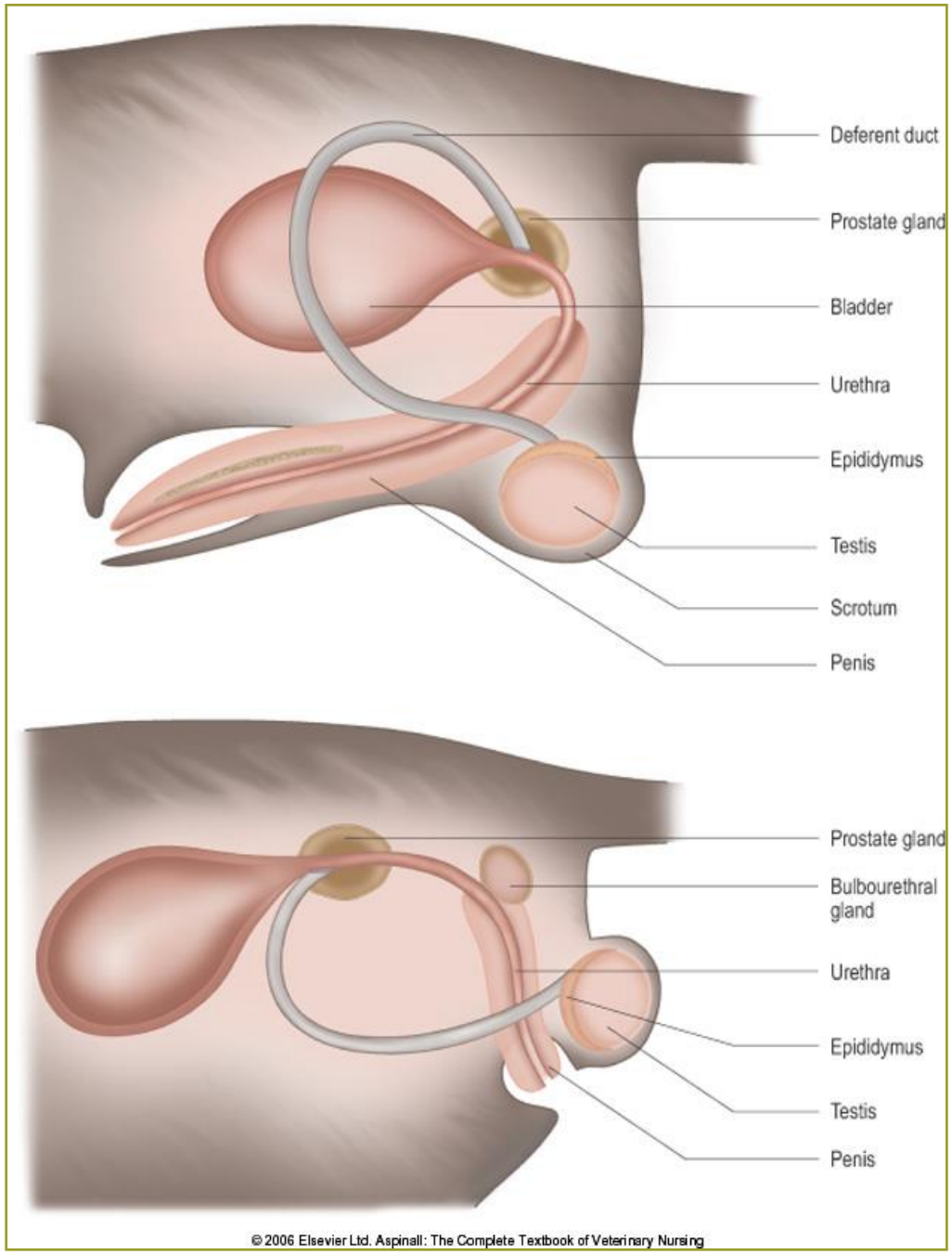
Comparative Anatomy (Canine)



Male Canine Urogenital System

Figure 17-3, Page 392



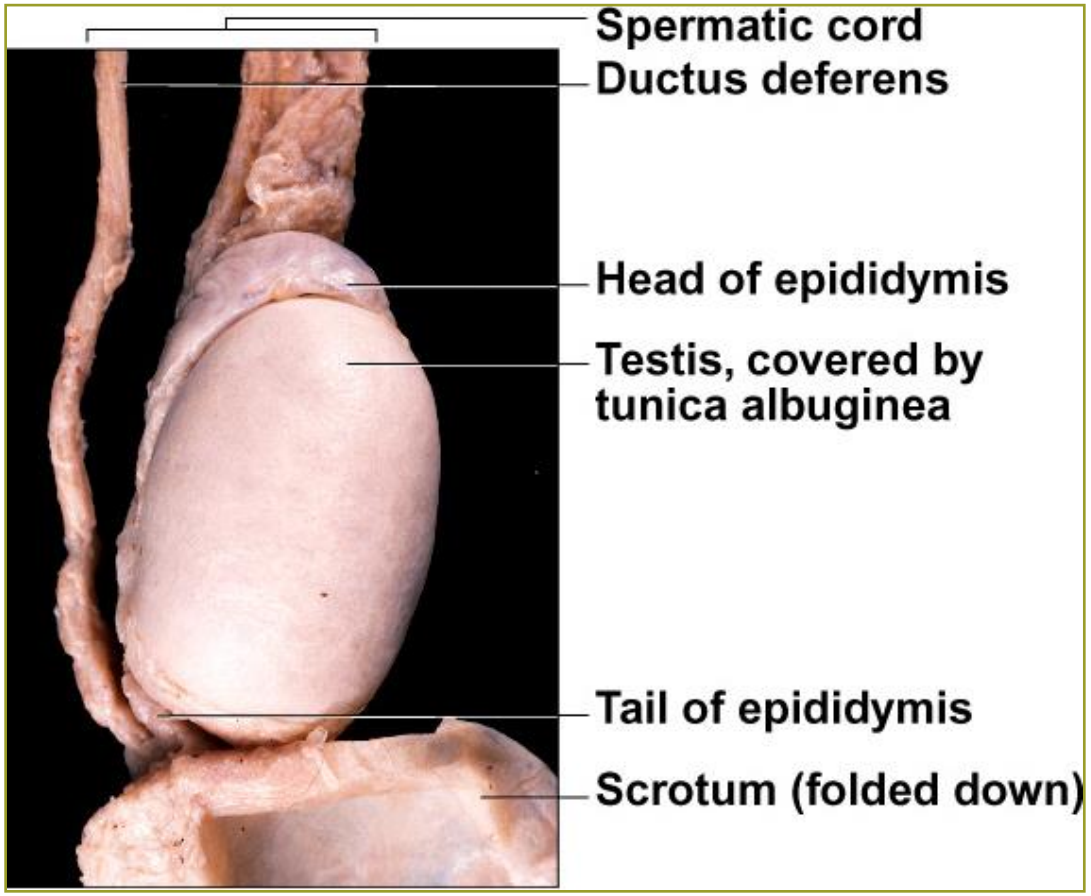


Comparative Anatomy – Male Dog & Cat

Male Reproductive System

Figures 17-2 to 17-6 – Pages 391 & 392

- Scrotum
  - Cremaster muscle
  - Tunica albuginea
- Testicles (testes)
- Epididymis
- Spermatic cord
  - Ductus deferens deferens)
  - Testicular vessels



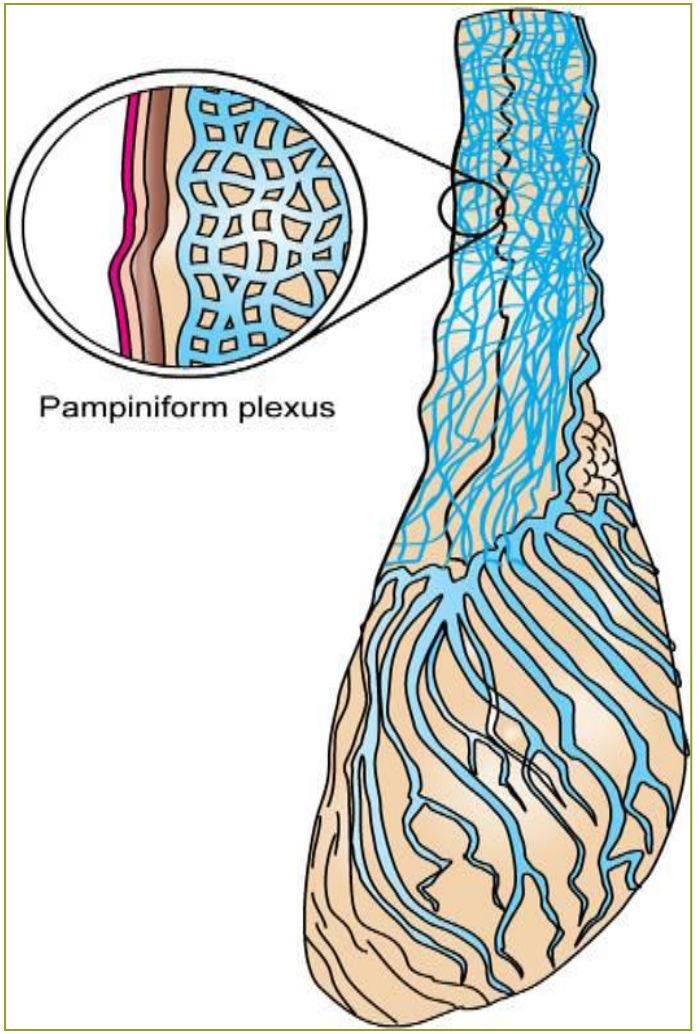
Scrotum

- Sac of skin that houses the testes
- **Helps regulate temperature of testes**
  - Testes must be kept slightly cooler than body temperature
- **Cremaster** muscle passes down through the inguinal ring and attaches to the scrotum.
  - Adjusts the position of the testes relative to the body depending on temperature

Spermatic Cord

Figure 17-9, Page 394

- Blood and lymphatic vessels, nerves, and the vas deferens.
- **Pampiniform plexus** – meshwork of veins that surrounds testicular artery
  - Maintains testes at a temperature slightly lower than body temperature
  - Warms blood back to body temperature before it returns to the abdomen.



Canine Reproductive System

Bassert Lab Manual – Page 419

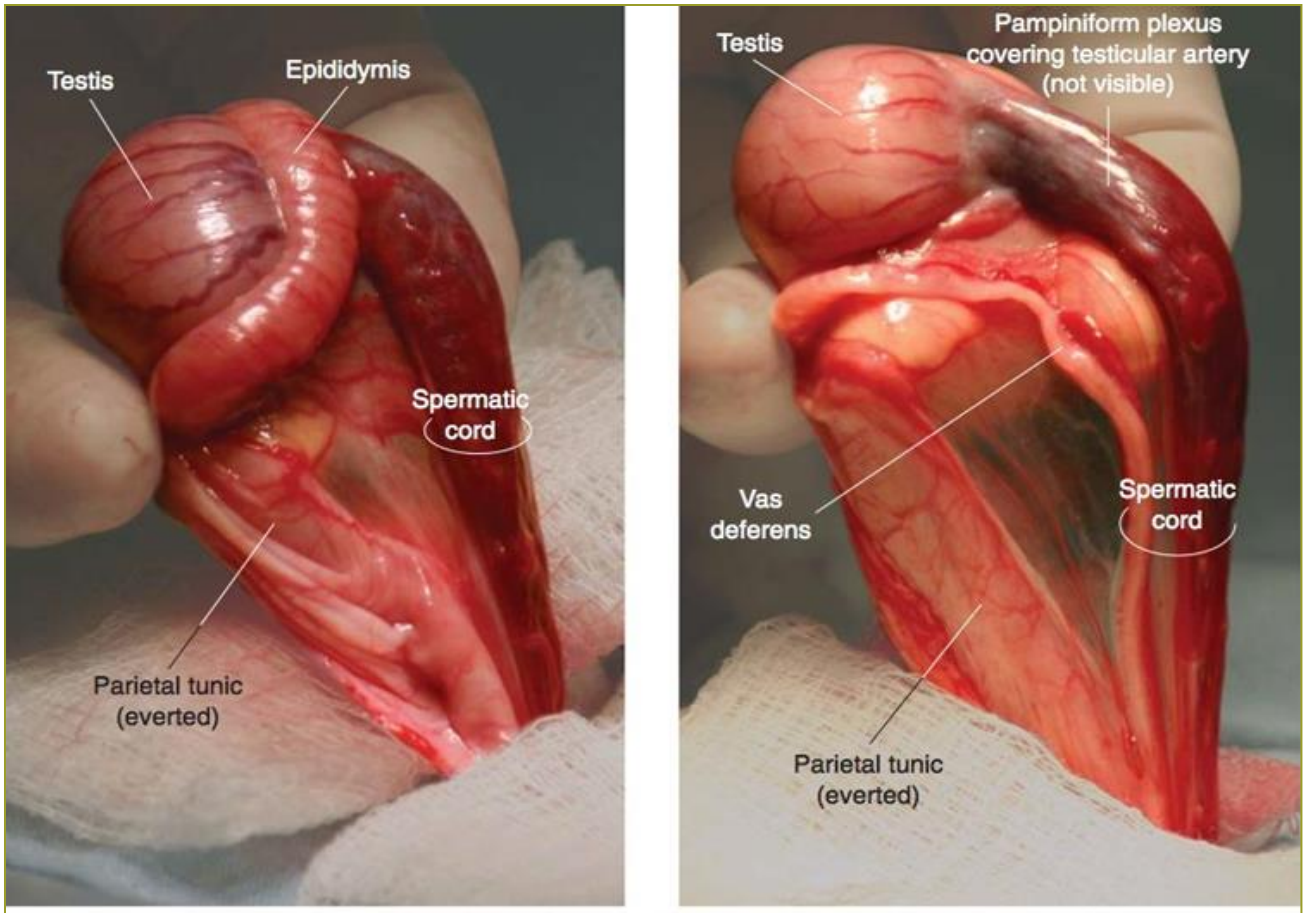
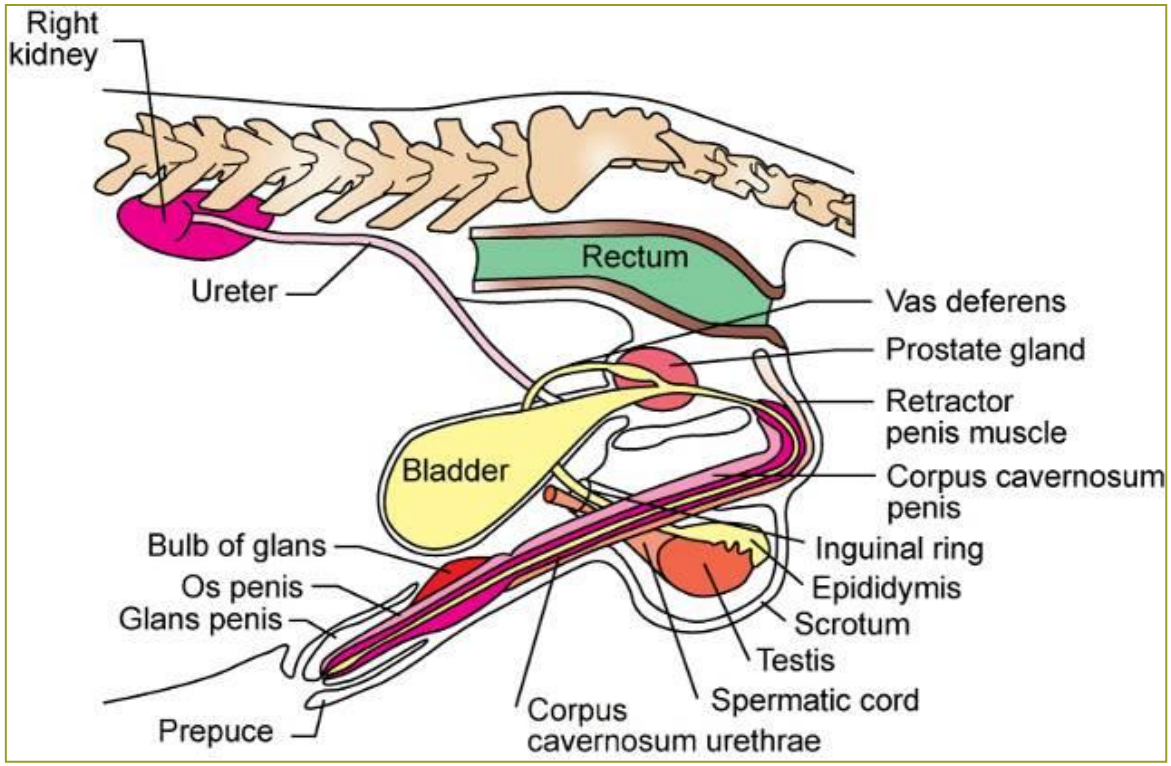


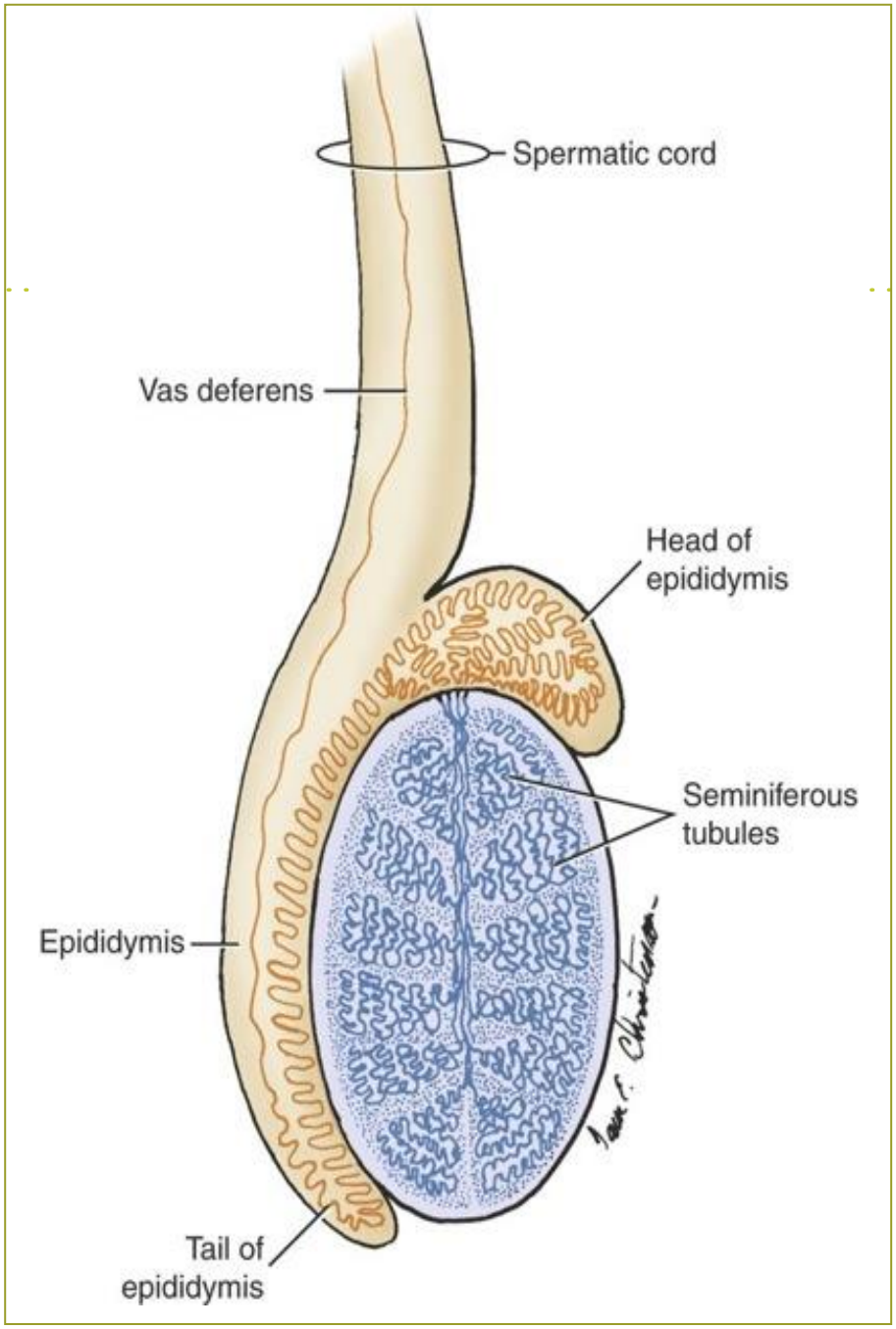
Figure 15-7 Canine Testis, Epididymis, Vas Deferens, and Spermatic Cord Removed From Scrotum.

Testes (Testicles)

- **Produce sperm and hormones**
- Located outside the abdomen in the inguinal region
- Housed in a sac of skin – the scrotum



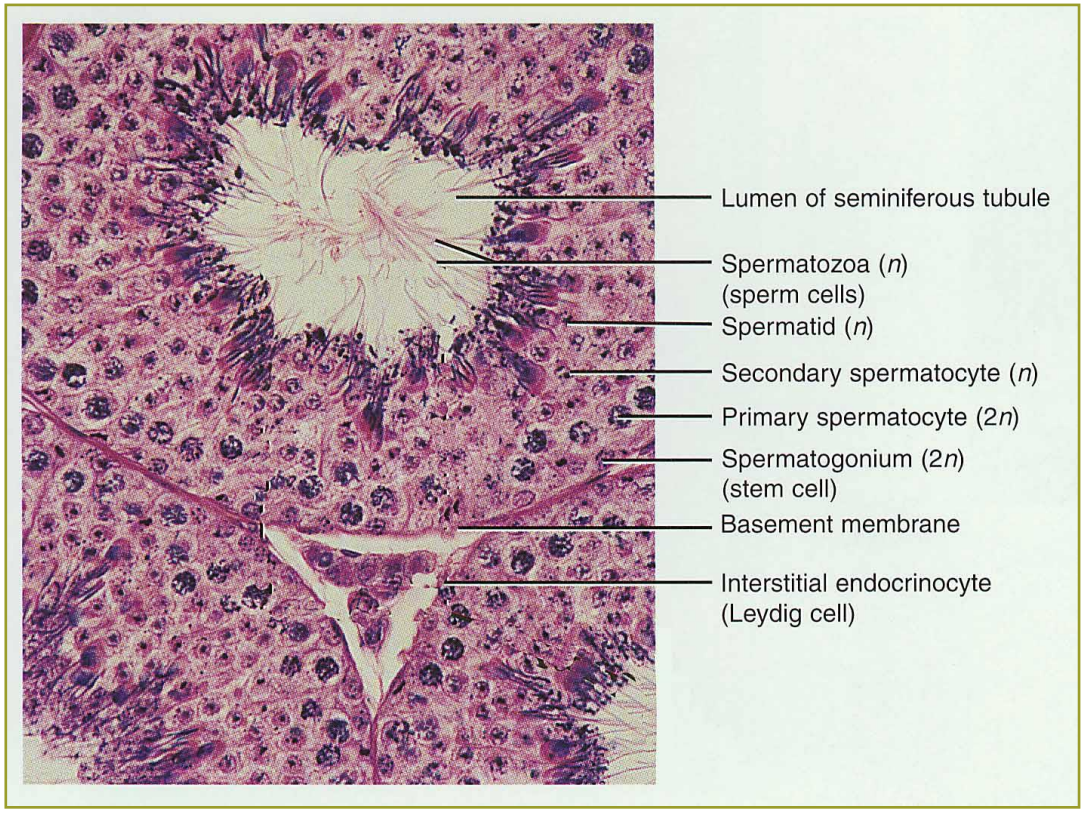
Testis (Cross Section)



Histology of Testicle

Figure 17-6, Page 392

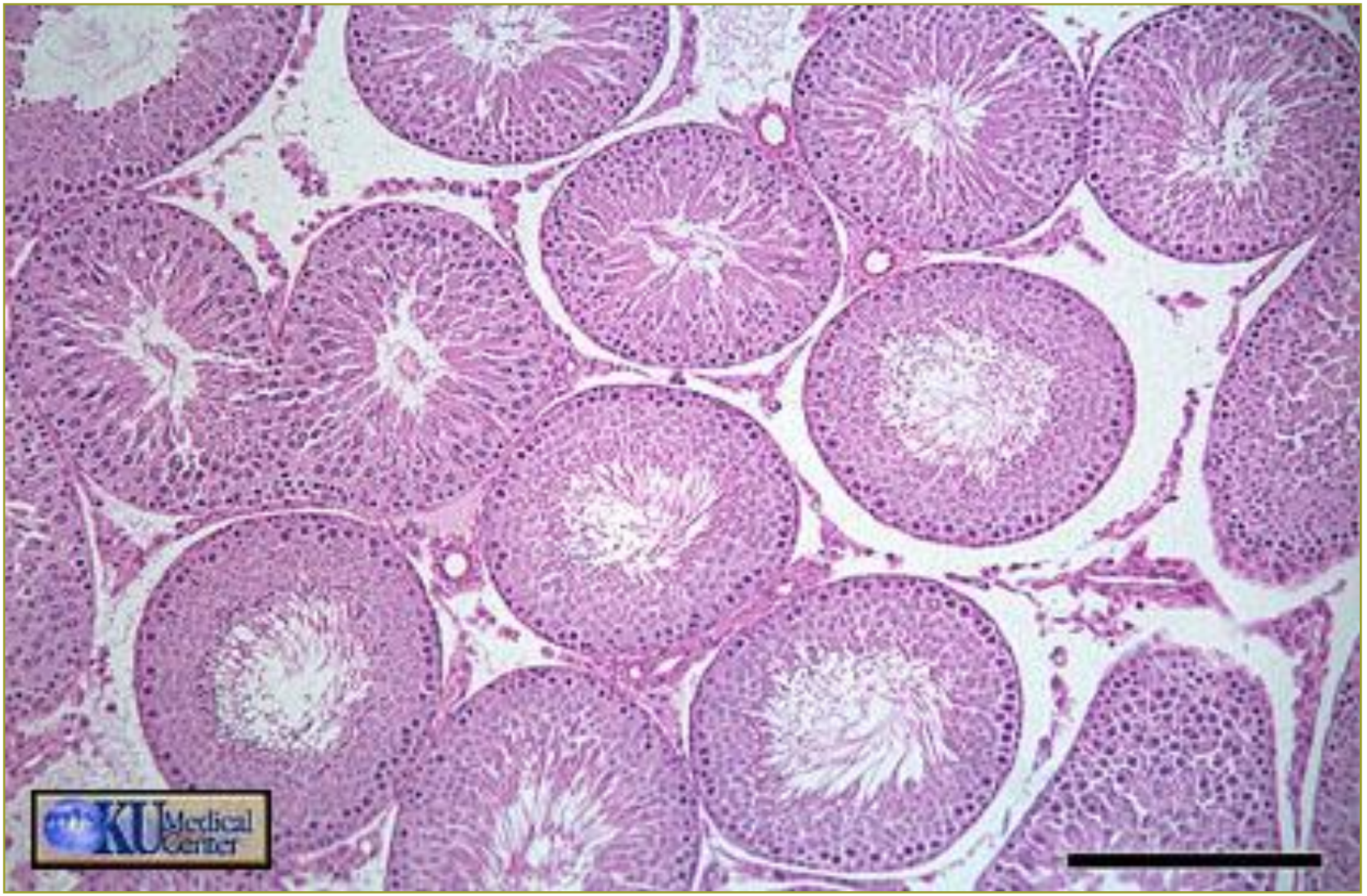
- **Seminiferous tubules**
  - Produce sperm (spermatogenesis)
- **Interstitial cells** (Cells of Leydig)
  - Produce testosterone



Seminiferous Tubules

- **Site of spermatogenesis**
- Long, convoluted U-shaped tube attached at both ends to system of ducts (rete testis)
- **Interstitial cells** – endocrine cells between the seminiferous tubules -produce androgens
- **Sertoli cells** – Support developing spermatids

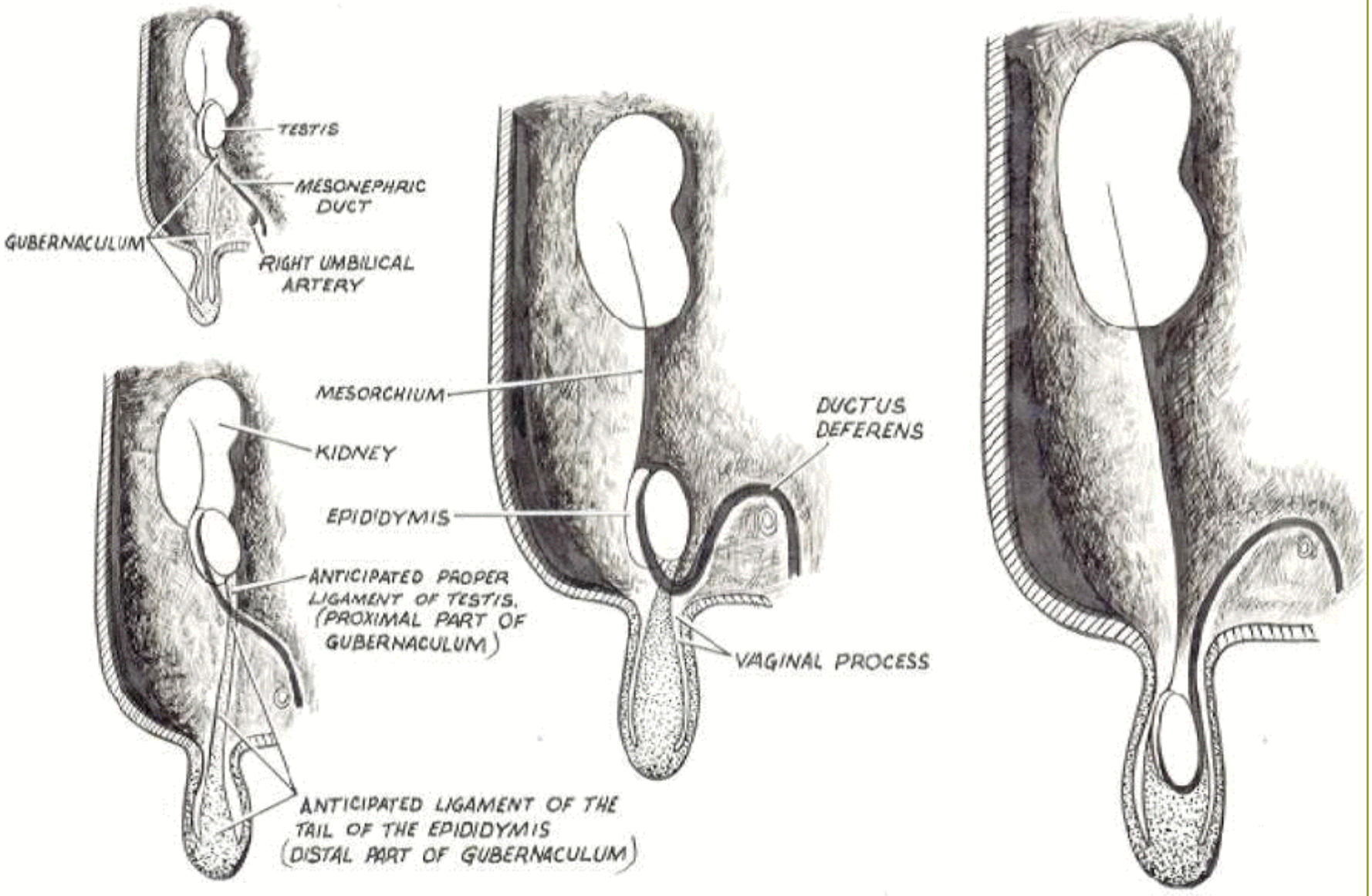
Seminiferous Tubules



Testicle Development

Figure 17-7, Page 393

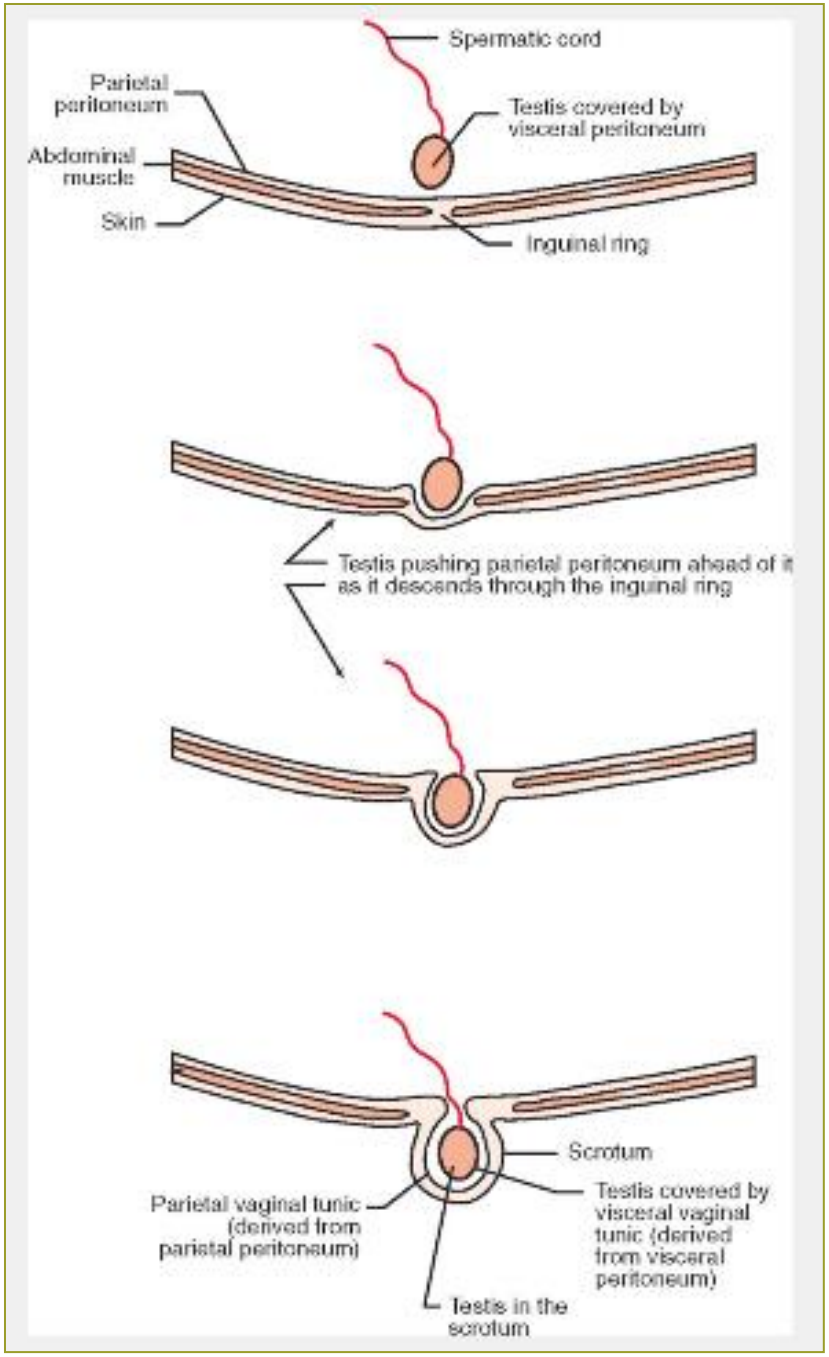
- Develop just posterior to kidneys
- Descends into scrotum by passing through inguinal canal
- **Gubernaculum** (cordlike structure containing muscle) extends from the testicle to the inner lining of scrotum
  - It shortens, and guides the testicle to the scrotum



A SCHEMATIC DIAGRAM OF THE DESCENT OF THE TESTIS.

Descent of Testes

Figure 17-7, Page 393



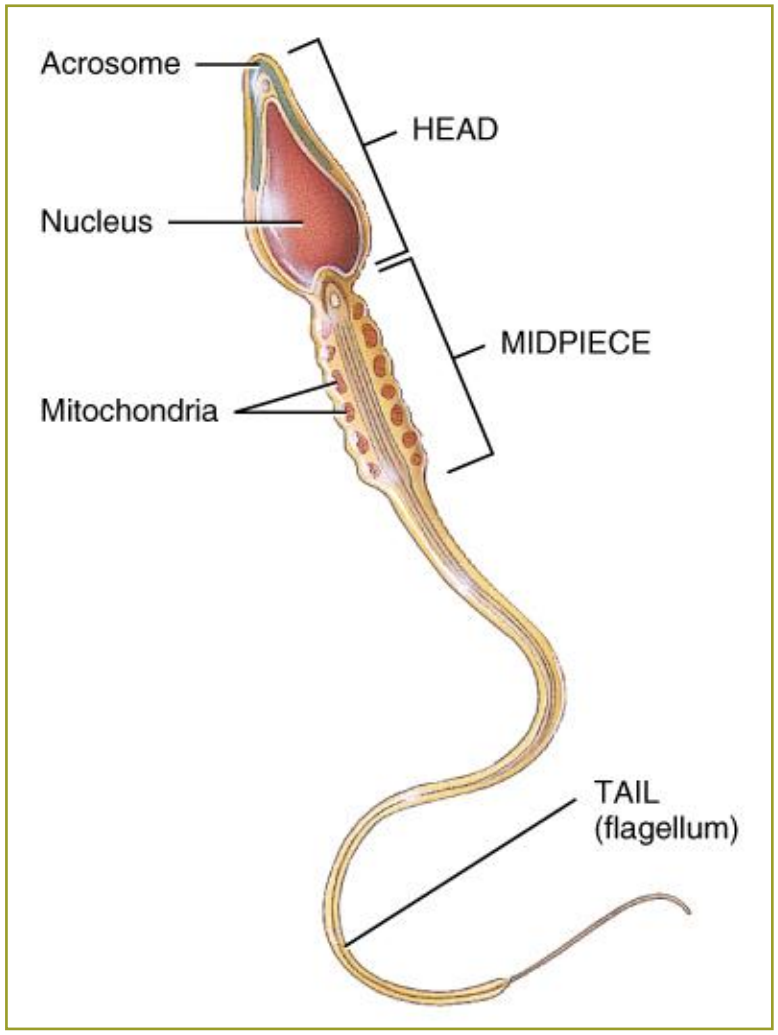
Spermatozoa Structure

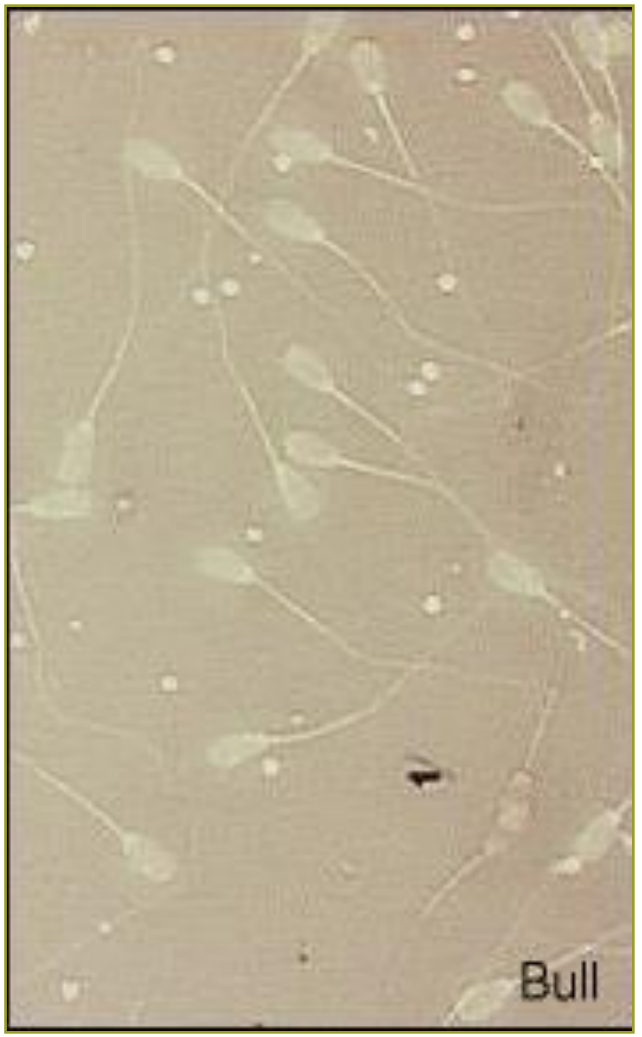
Head

Midpiece

Tail

Sperm Structure

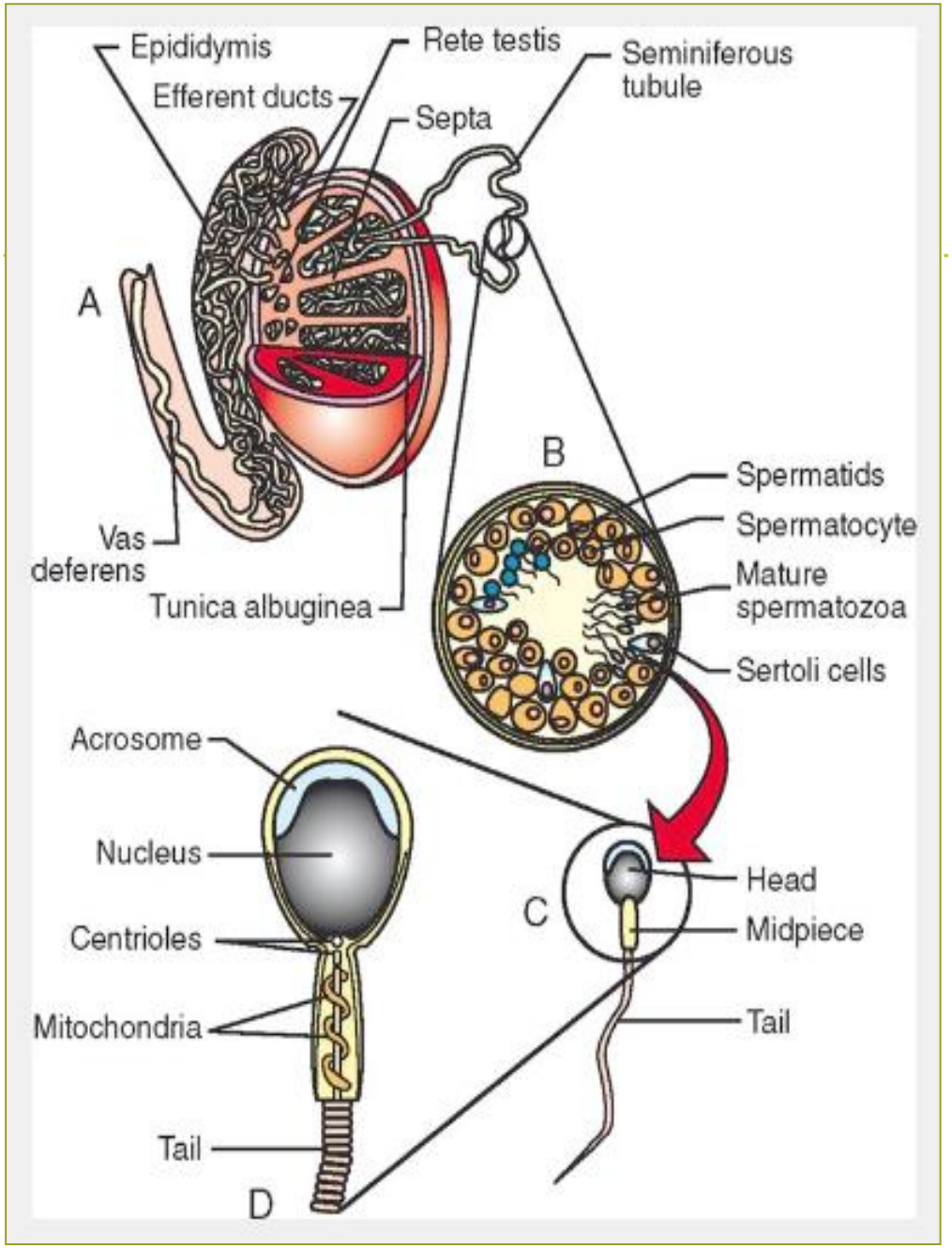




Head

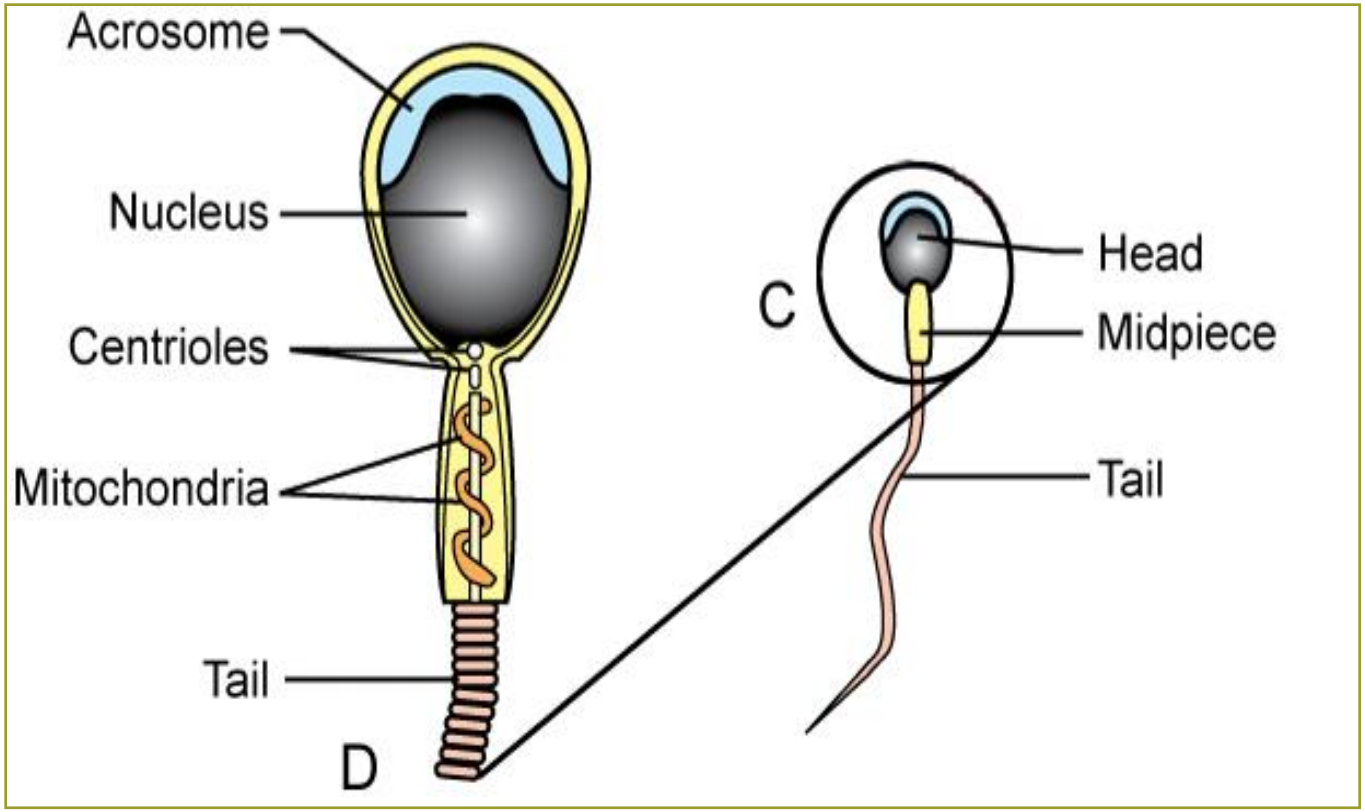
Figure 17-6, Page 392

- Contains nucleus
- Covered by **acrosome**
  - Contains digestive enzymes that help spermatozoon reach and penetrate ovum



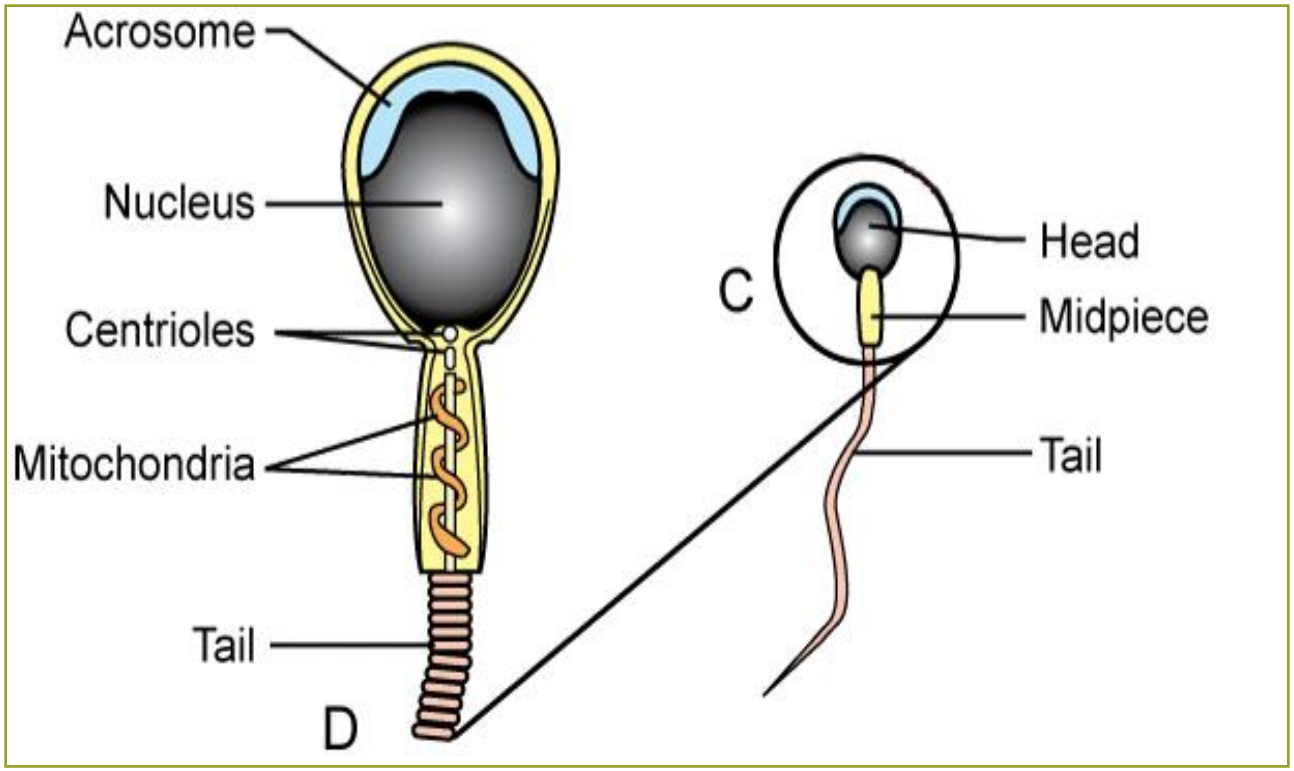
Midpiece

- Large concentration of mitochondria arranged in a spiral pattern



Tail

- Contains muscle-like contractile fibrils
  - Produces a whip-like movement of tail and propel sperm cell forward



Duct System

- After detaching from Sertoli cells, spermatozoa enter the rete testis
- Then flow through the efferent ducts to the epididymis
  - Single, long, convoluted tube that connects the efferent ducts of the testis with the vas deferens
  - Storage and maturation of spermatozoa
- Then flow into the vas deferens of the spermatic cord

Vas Deferens

- **Ductus deferens**; part of the spermatic cord
- Passes through inguinal ring then separates from spermatic cord and connects with **urethra**
- **Ampulla** – enlargement of the vas deferens just before it joins the urethra found in some species
  - contain glands that contribute material to semen

Canine Reproductive System

Bassert Lab Manual – Page 419

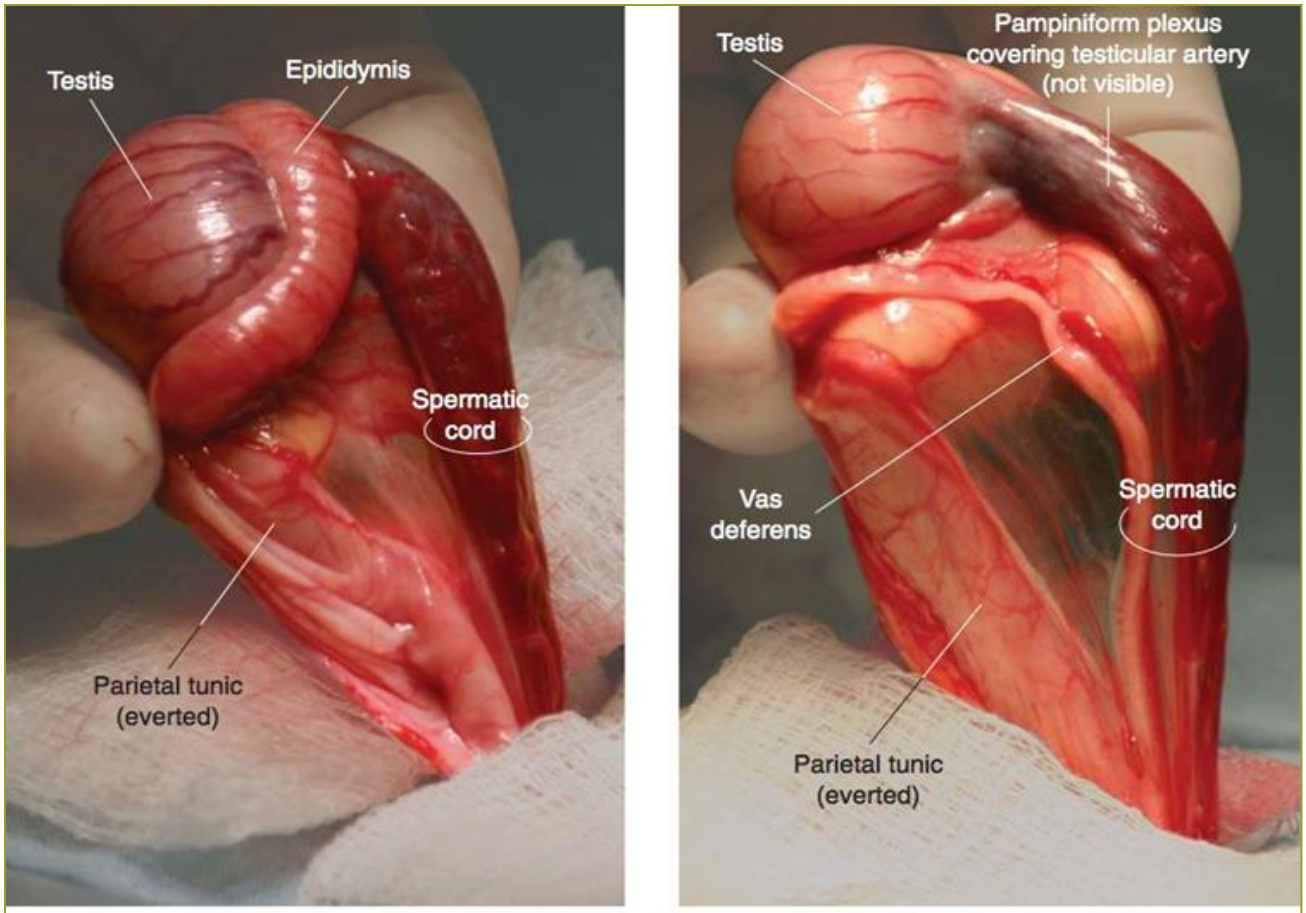
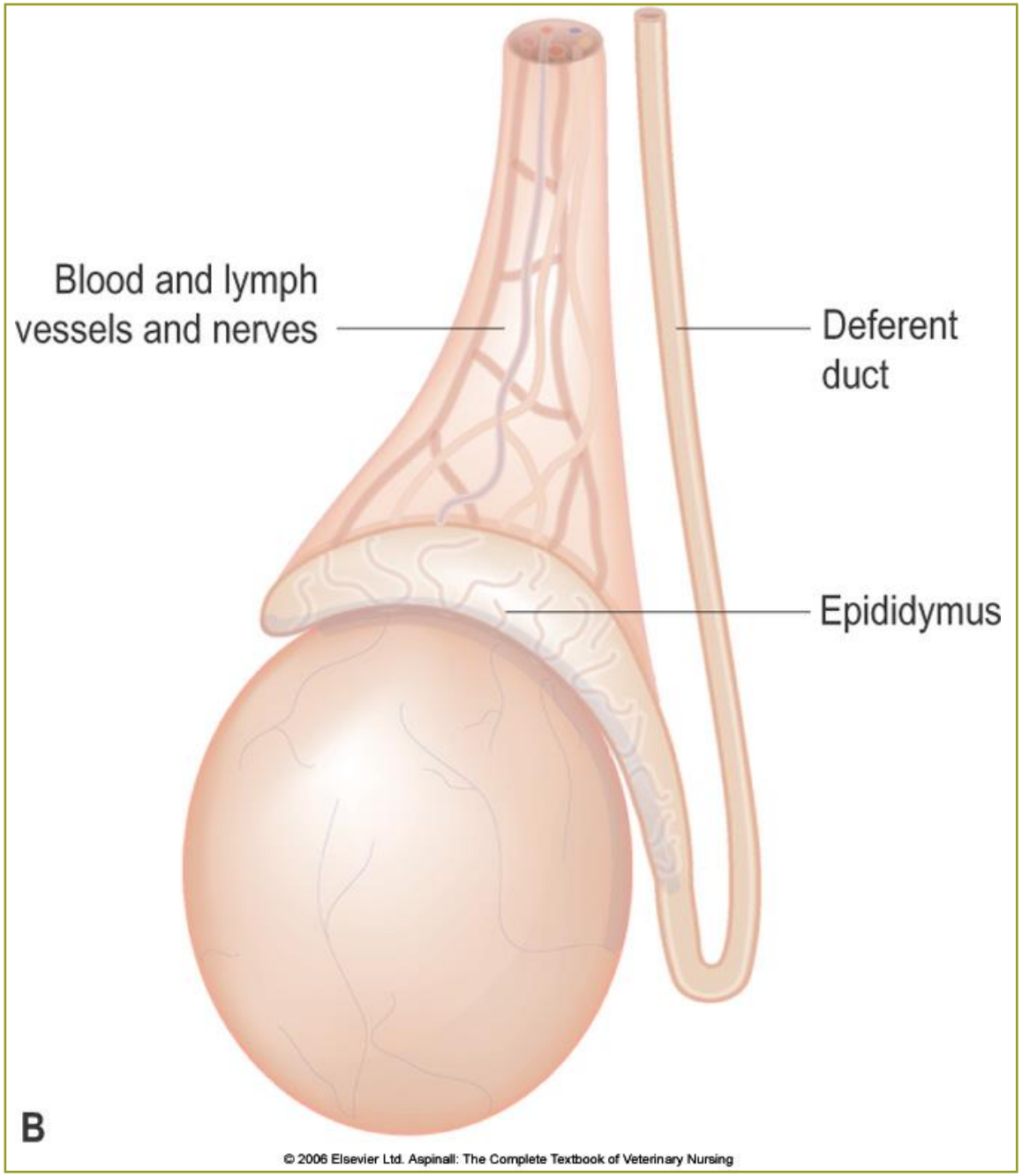


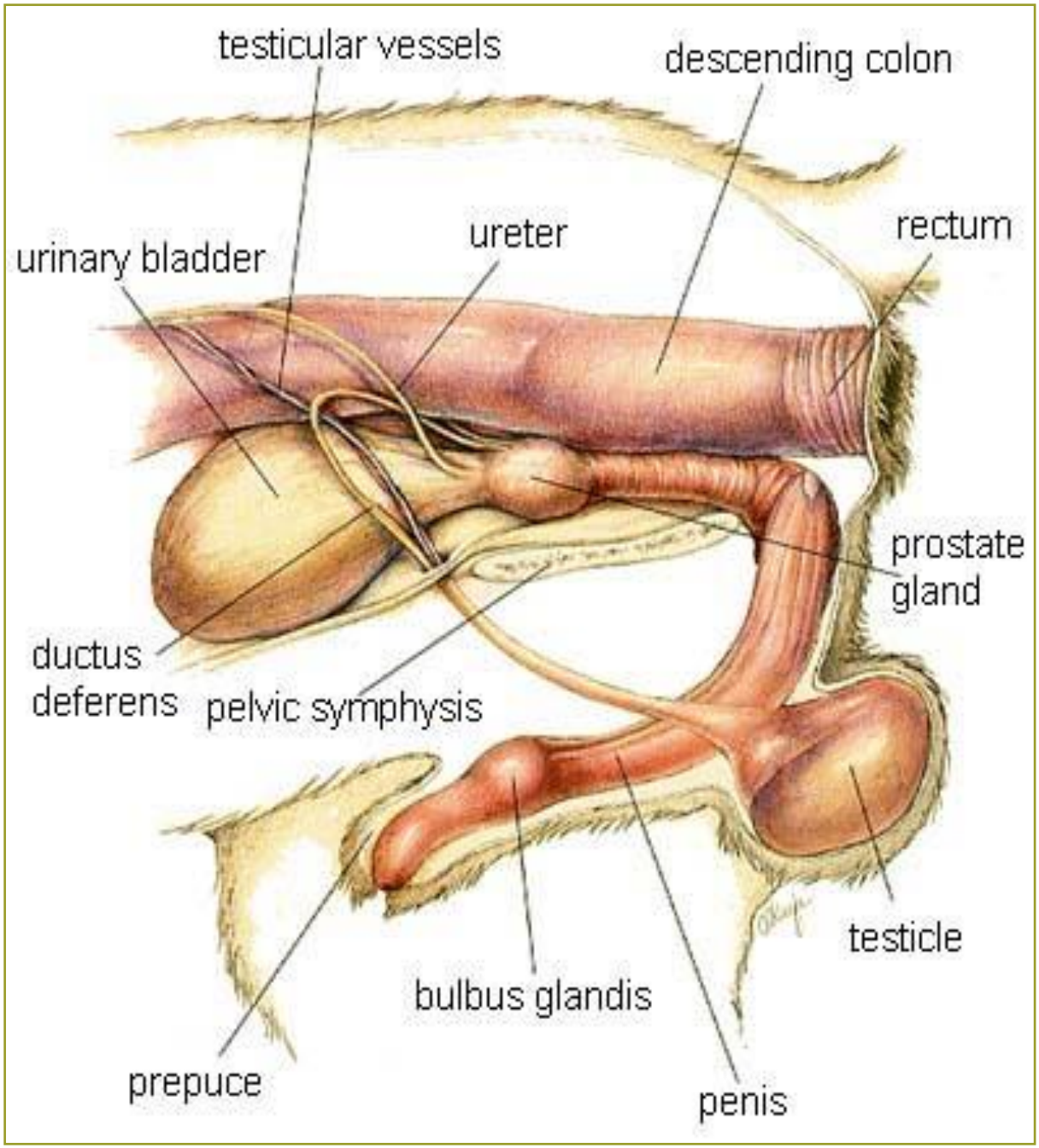
Figure 15-7 Canine Testis, Epididymis, Vas Deferens, and Spermatic Cord Removed From Scrotum.



Urethra

- **Pelvic** portion - entry point of vas deferens and accessory reproductive glands
- **Penile** portion - runs down the length of the penis
- Spermatozoa from vas deferens and secretions from accessory reproductive glands enter urethra and are pumped out as **semen**
- Carries urine from the urinary bladder outside the body.
  - **Urine flow temporarily blocked when ejaculation occurs**

Review Male Anatomy – Trace a Sperm Cell



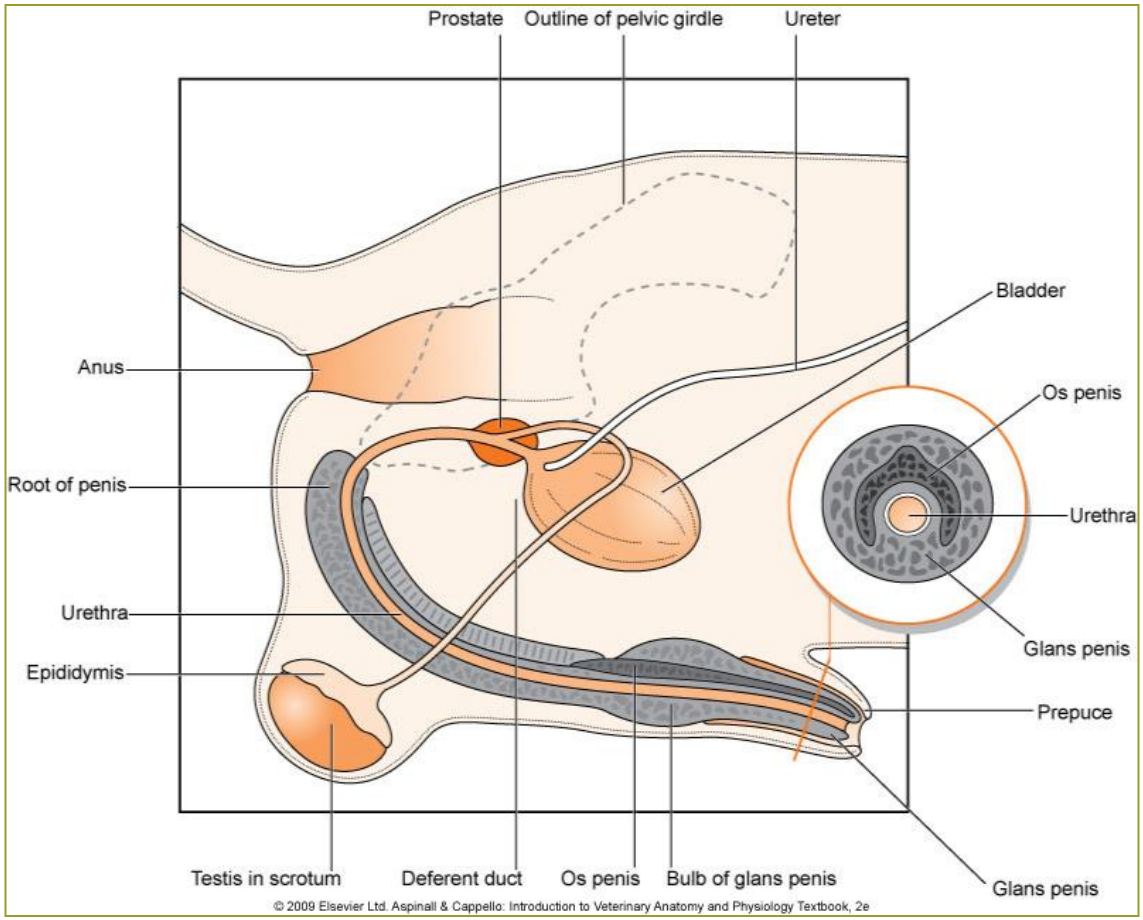
Test Yourself – GREAT Questions!

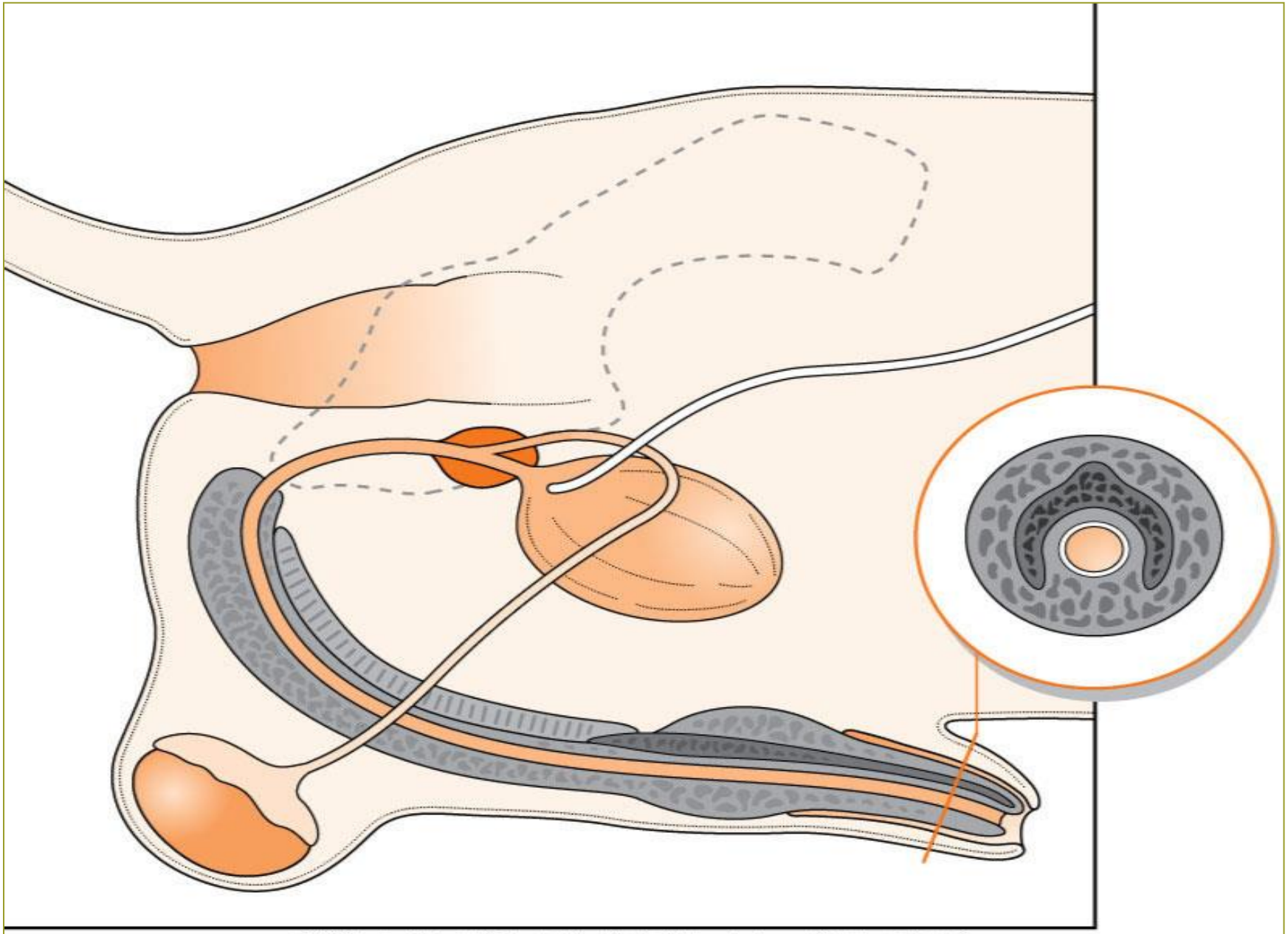
Bassert textbook – Page 395

TEST YOURSELF

1. What are the two main functions of the testes? Where in the organ does each take place?
2. What are the three main parts of a spermatozoon? What is the main purpose or function of each?
3. Why is a bilaterally cryptorchid animal usually sterile?
4. Would a bilaterally cryptorchid animal exhibit normal male behavior? Why or why not?
5. What is important about the scrotum's ability to adjust the position of the testes relative to the body?
6. What are the main components of the spermatic cord?
7. From what are the visceral and parietal vaginal tunics that cover the testes derived?
8. Where are spermatozoa stored before ejaculation?

Male Dog – Anatomy Review





Tom Cat – Anatomy Review