CHAPTER 2
FEMALE REPRODUCTIVE ANATOMY (PART I)

General Functions of the Female Reproductive Tract

- Produce oocytes
- Transport sperm
- Facilitate fertilization
- Provide environment for embryo and fetus
- Give birth to fetus
- Recycle to become pregnant again
- Provide nutrients to young

Supportive Tissues: BROAD LIGAMENT

A. Supports Reproductive Tract in Abdomen
B. Three Parts:
   1. Mesovarium — supports ovary
   2. Mesosalpinx — supports oviduct
   3. Mesometrium — supports uterus (uterine body & horns)

Three Layers of the Female Reproductive Tract

1) Tunica serosa (Perimetrium)
   a. Outermost layer
   b. Connective tissue
2) Tunica muscularis (Myometrium)
3) Tunica mucosa (Endometrium)
   a. Consists of mucosa and submucosa

I. EXTERNAL GENITALIA (Figures 2-23 and 2-24)

A. Vulva (Consists of two labia, which form commissures)
   1. Labia minora
      a. Inner folds
b. Homologous to sheath

c. Small in farm animals

2. Labia majora
   a. Outer folds
   b. Homologous to scrotum
   c. Externally visible

B. Clitoris
   1. Homologous to penis
   2. Large in mare
   3. Highly innervated by nerve endings
   4. Highly sensitized area
   5. Stimulation may contribute to conception rates in cattle when cows inseminated artificially

II. POSTERIOR (CAUDAL) VAGINA (Figures 2-22, 2-5, 2-7, and 2-9)

Histology
   1. Stratified squamous epithelium

Function/Structure
   1. Region common to reproductive & urinary systems
   3. Stimulates male for copulation (Not present in humans)
   4. Passage for fetus during parturition

Components
   1. Hymen — embryonic remnant
      a. Mullerian duct — reproductive tract
      b. Urogenital sinus — vestibule
   2. External urethral orifice — opening of urethra
   3. Suburethral diverticulum — blind pocket (sow & cow)
      a. Helps block urine from entering uterus
   4. Vestibular glands
      a. Bartholin’s glands (Pair of glands located in vestibule wall)
         i. Secrete during estrus
         ii. Lubricate vagina
Posterior vagina has no or limited glands, low degree of mucus secretion and epithelial thickness changes with the stage of the estrous cycle.

III. ANTERIOR (CRANIAL) VAGINA (Figures 2-22, 2-5, 2-7, and 2-9)

Histology
1. Simple columnar epithelium (different from caudal vagina) (Fig. 2-22)

A. Female Copulatory Organ
1. Site of semen deposition — cow, ewe, doe, human
3. Luminal epithelium (near the cervix) is secretory (mucus)
4. pH is acidic (5.7) – Bacteriostatic
5. Stimulates glans penis of the bull

B. Structure
1. Length
   a. Cow = 35-30 cm
   b. Ewe, doe, sow = 10-15 cm
2. Outer layer
   a. Tunica serosa
3. Middle layer
   a. Circular muscle
   b. Longitudinal muscle
4. Inner mucosal muscle
   a. Stratified squamous epithelium

C. Mucosa Responds to Hormones
1. High estradiol
   a. Epithelial cell growth
   b. Cornified (dead) cells — lack a nucleus
   c. Increase in leukocytes (WBC)
   d. Estrus detection in rodents

D. Contains a large crypt (pocket) called the fornix vagina
*Fornix vagina is absent in the sow and mare


**IV. CERVIX (Figures 2-20, 2-21)**

**Histology**

1. Simple columnar epithelium

A. Structure

1. Technically part of the uterus
2. Thick-walled & inelastic
3. Anterior portion continuous with uterus
4. Fornix -- blind sac formed by cervix protruding into vagina
5. Histology
   a. Tunica serosa — outer layer
   b. Middle layer — mostly connective tissue; some smooth muscle
   c. Inner layer — secretory epithelium secretes mucus; few ciliated cells

B. Types of cervix:

1. Annular rings
   a. Found in cow, ewe, doe — act to seal uterus
      (1) cow: 3-4 rings
      (2) doe: 5 rings
      (3) ewes: 6-7 rings

2. Interdigitating prominences
   a. Found in the sow – accommodates a corkscrew-shaped penis in the boar

3. Longitudinal folds
   a. Found in the mare – softens during copulation

B. Functions

1. Isolates the uterus from the external environment (acts as barrier)
   b. Cervical mucus — flows into vagina
   c. Cilia — beat toward vagina

2. Passage for sperm
   a. Sows & mares — site of sperm deposition
   b. Sperm reservoir
i. sperm held in cervix
ii. sperm long lived in cervix
iii. provides slow sperm release — increases chance of fertilization

c. Sperm selection — heterologous inseminations
d. Mucus and anatomy of cervix act as a sperm filter in some species
   *Prevents large numbers of sperm from reaching oviduct in cow and ewe

3. Responsible for isolation of the conceptus (fetus) within uterus from external environment
   a. Cervical plug (cervical seal)
      i. formed during pregnancy
      ii. formed from mucus
      ii. liquifies at parturition

C. Cervical Mucus
   1. Properties:
      a. Biochemical and physical properties of the mucus changes during the estrous cycle
      b. Hormones change properties:
         i. high progesterone — thick, viscous mucus
         ii. high estradiol — thin, watery mucus

   2. Lubricant at parturition
      a. Cervix expands due to fetal pressure

V. UTERUS (Figures 2-7 to 2-9, 2-16, and 2-17)

Histology
   1. Simple columnar

Divided into Two Parts
   1. Uterine horns (2)
      a. Size varies with uterine type
      b. Cow, ewe, sow, doe — 80-90% of total length
      c. Small in horses
d. Absent in humans

e. **Bifurcation** – point where uterine horns split from uterine body

2. Uterine body
   a. Area common to both sides of female tract

**Structure**

1. Perimetrium (tunica serosa)
   - Outer serous layer continuous with peritoneum - blocks adhesions
     a. Outermost layer
     b. Connective tissue

2. Myometrium (tunica muscularis)
   a. Middle layer of muscle
   b. Contains 3 layers:
      i. Two outer layers longitudinal muscle
      ii. One inner layer circular muscle

3. Endometrium (tunica mucosa)
   a. Provides point of placental attachment and glands provide secretions for embryo development (estradiol and progesterone)
   b. Innermost layer
   c. Highly secretory
   d. Simple secretory glands

**Functions**

a. Nourish the embryo -- secretes **histotrophe** or uterine milk

b. Site of implantation (Figure 2-17)
   i. Exchange with maternal system through the uterine wall *(placentome)*

c. Sperm transport
   1. Primarily muscular contraction
   2. Sperm move faster than can swim

D. Expulsion of the fetus and fetal placenta
   1. Muscles of myometrium contract during parturition
   2. Responsiveness of myometrium varies with hormonal state

E. Control of estrous cycle and luteolysis
1. Communicates with the ovary about presence of embryo -- determines the life of the corpus luteum
   a. Secretion of prostaglandin F2α in the absence of the fetus to regress the corpus luteum

**Types of Uteri (Figure 2-15)**

A. Duplex
   1. In rat, rabbit, guinea pig
   2. Have 2 cervices — one for each horn
   3. No embryo migration possible

B. Bicornuate
   1. In cow, ewe, sow, doe
   2. Large uterine horns
   3. Small uterine body
   4. In cows, ewes, & does — external fusion makes body appear large

C. Bipartite
   1. In horse
   2. Small uterine horns
   3. Large uterine body

D. Simple
   1. In humans and primates
   2. Large, pear-shaped uterine body
   3. Non-existent horns