Animal Reproduction

Gynaecology

Lecture- 1

- **Veterinary Gynecology**: diseases of the sex organs of female animals and their treatment and prevention/ patho physiology of female genital tract

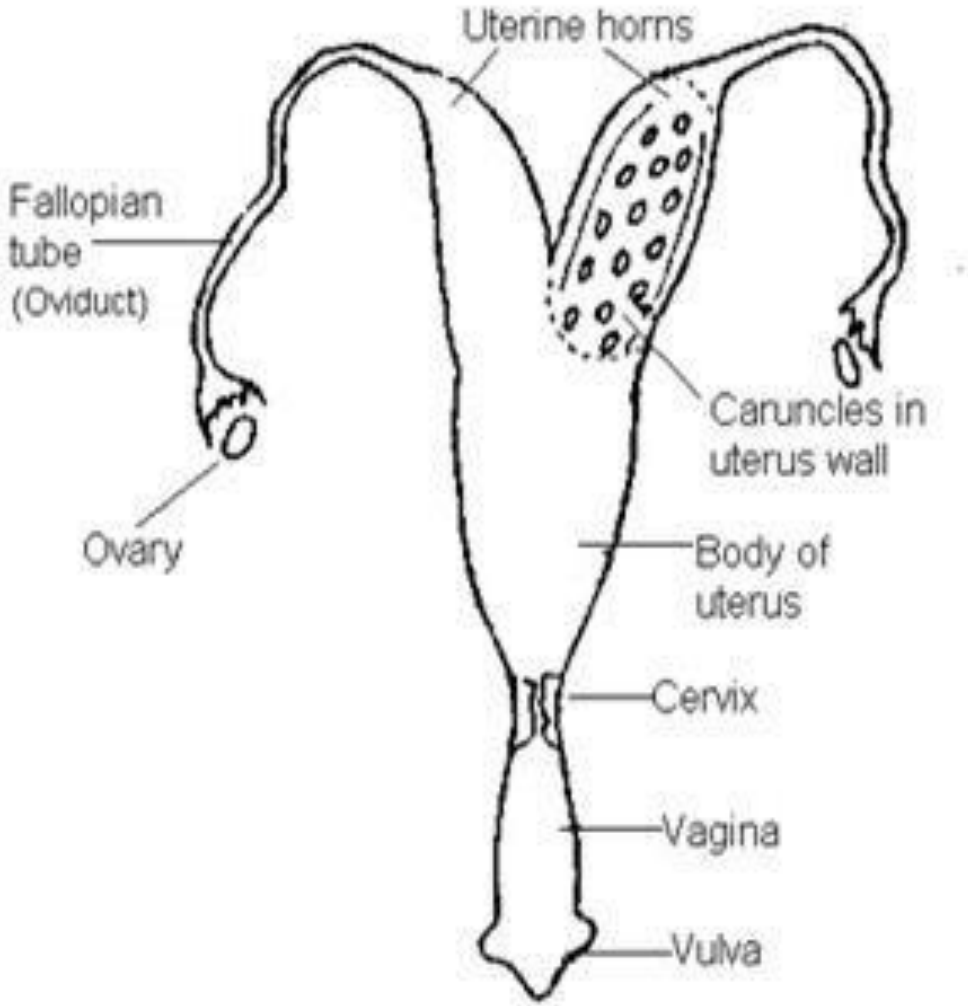
- **Vety. Obstetrics: care and management** of dam during **pregnancy, before, and after parturition**.

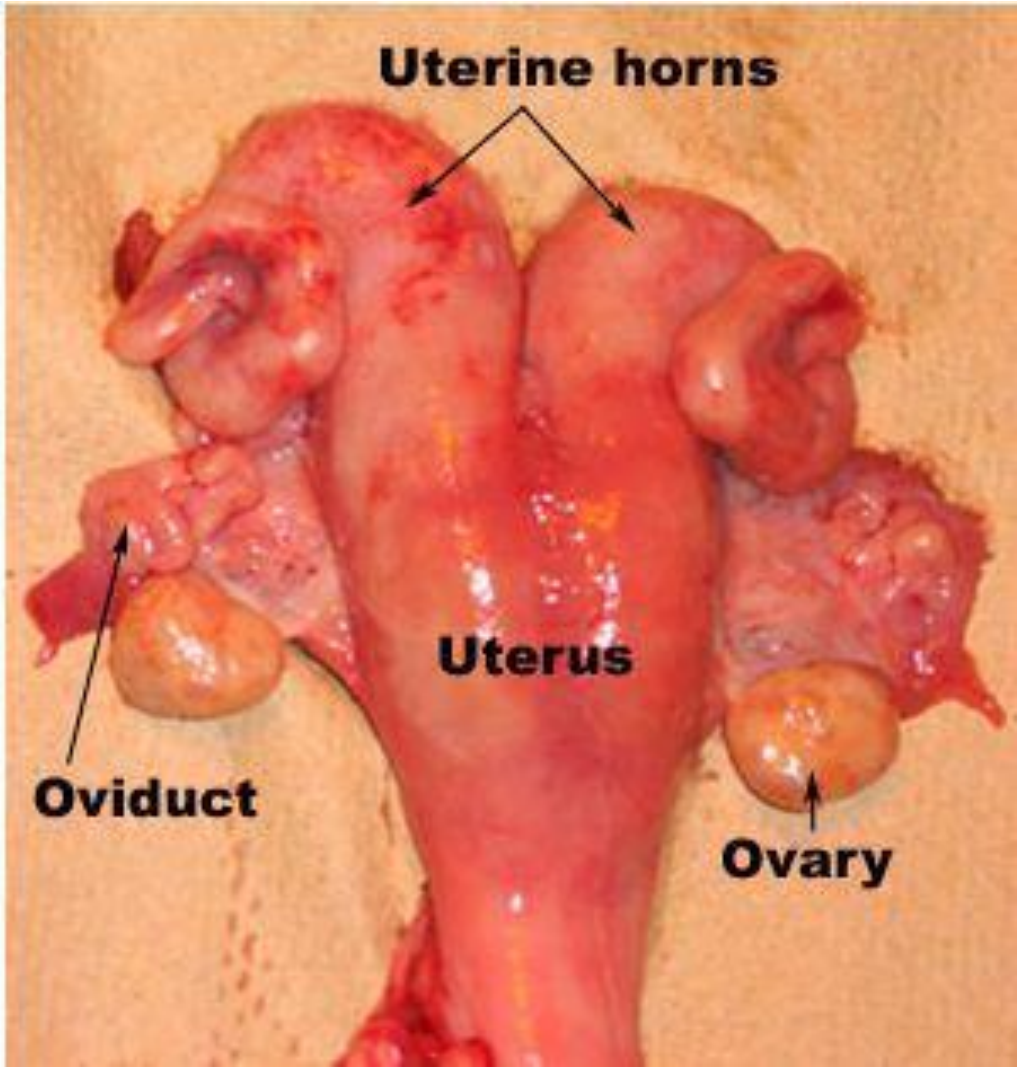
- **Theriogenology**: study of **obstetrics, gynaecology and andrology**.

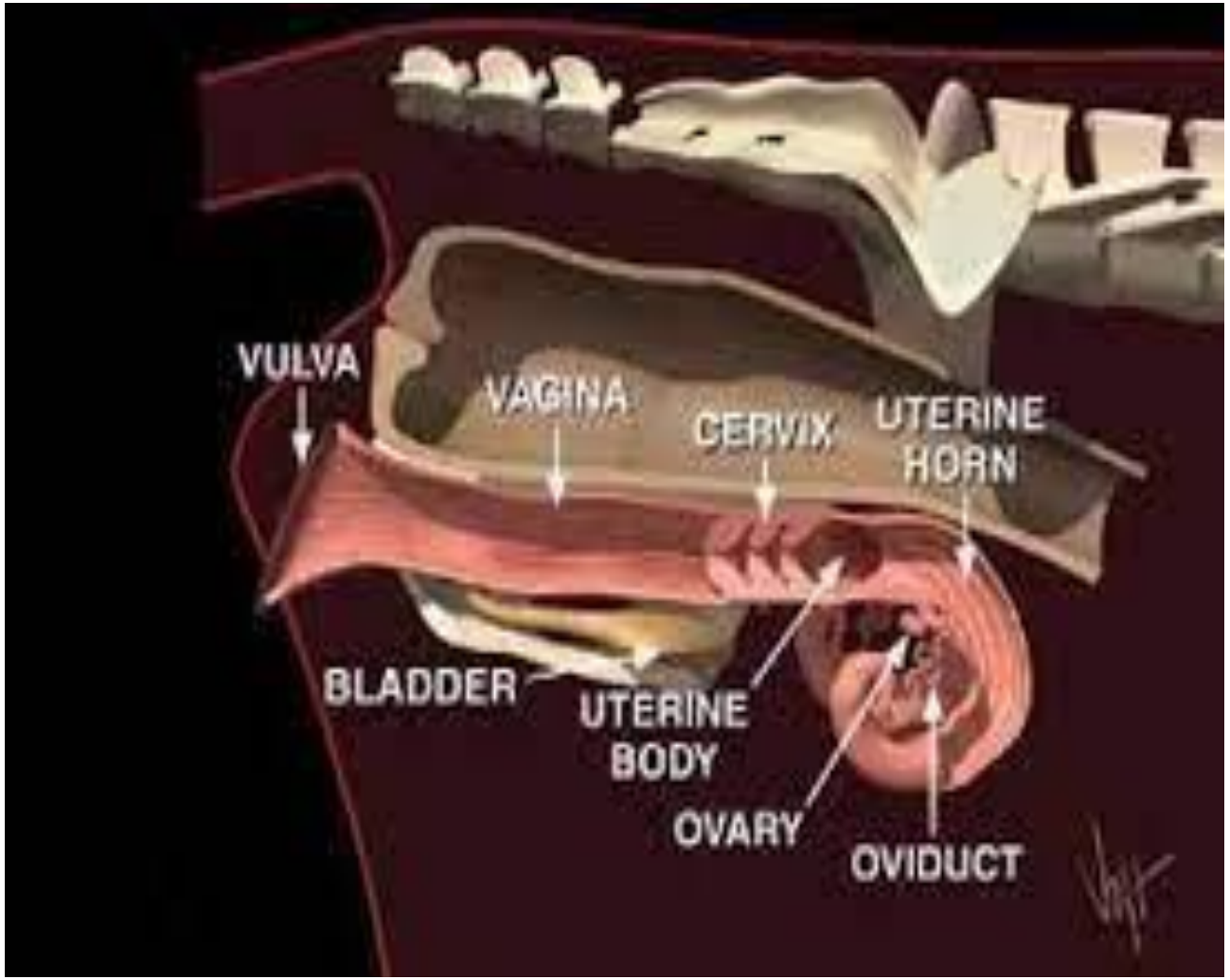
Development of Female genitalia

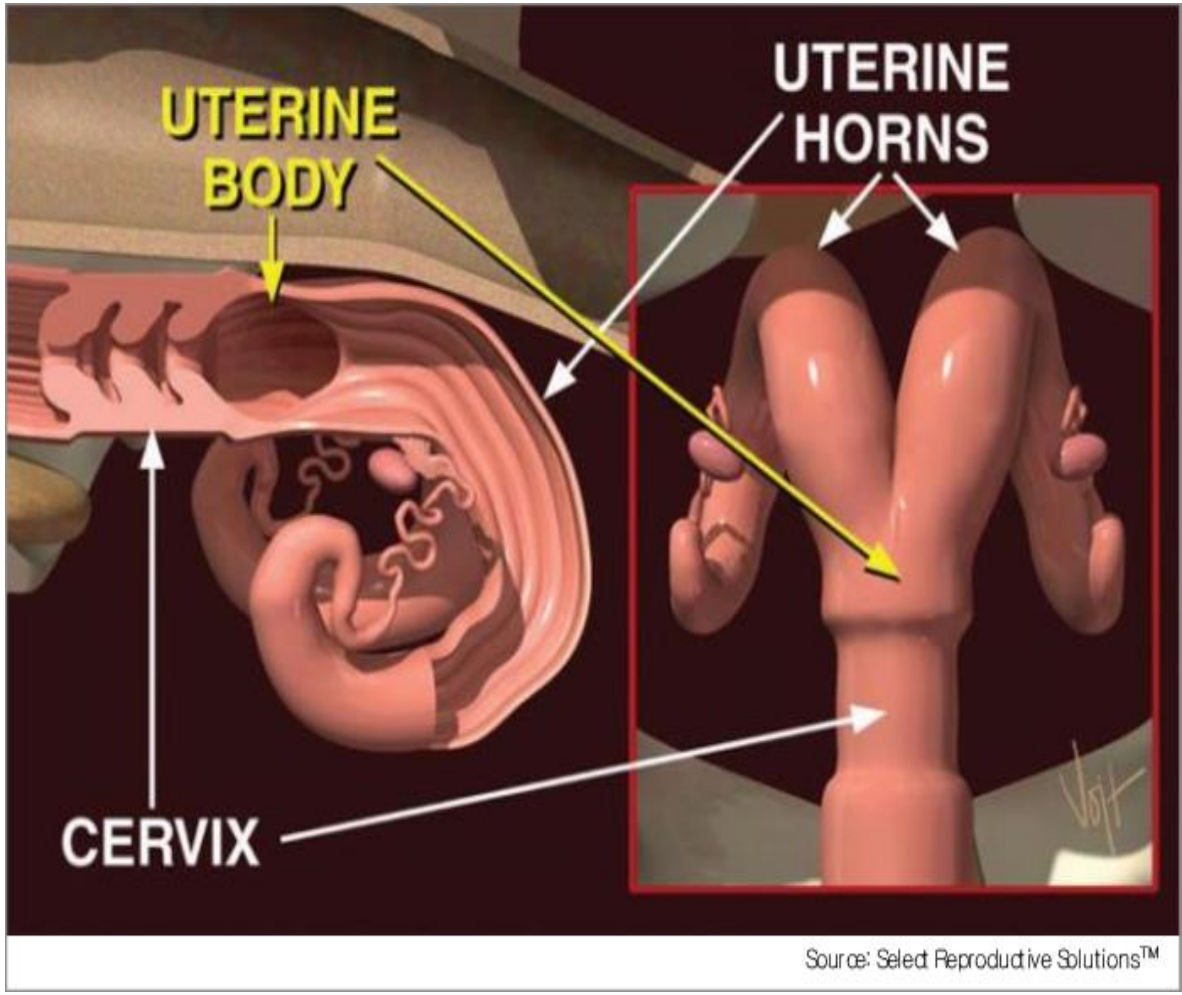
- **GENERATIVE ORGANS (OVARIES)**

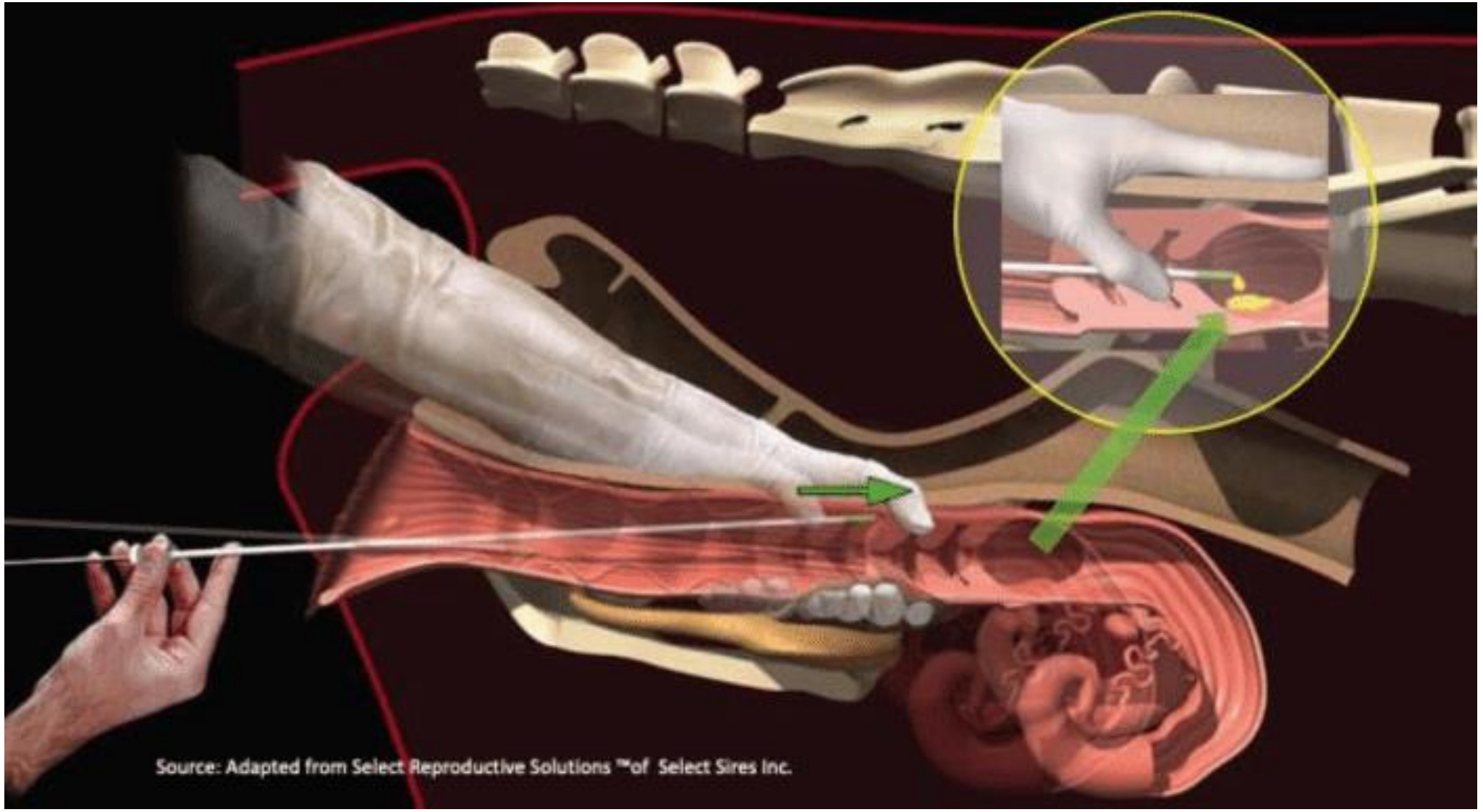
- TUBULAR GENITALIA – OVIDUCTS
  - UTERINE HORNS
  - CERVIX
  - VAGINA


Uterine horns
Fallopian tube (Oviduct)
Caruncles in uterus wall
Ovary
Body of uterus
Cervix
Vagina
Vulva


Uterine horns
Uterus
Oviduct
Ovary


VULVA
VAGINA
CERVIX
UTERINE HORN
BLADDER
UTERINE BODY
OVARY
OVIDUCT


UTERINE BODY
UTERINE HORNS
CERVIX
Source: Select Reproductive Solutions™


Source: Adapted from Select Reproductive Solutions ™of Select Sires Inc.

Embryonic Origin

- **mesonephric ducts** (Wolffian ducts) - male genital tract
- **paramesonephric ducts** (Mullerian ducts) – female genital tract

- ovaries, oviducts, uterus, cervix and the cranial portion of vagina arise from the primitive Paramesonephric ducts

- The vulva, vestibule and the caudal portion of the vagina develop from the urogenital sinus.

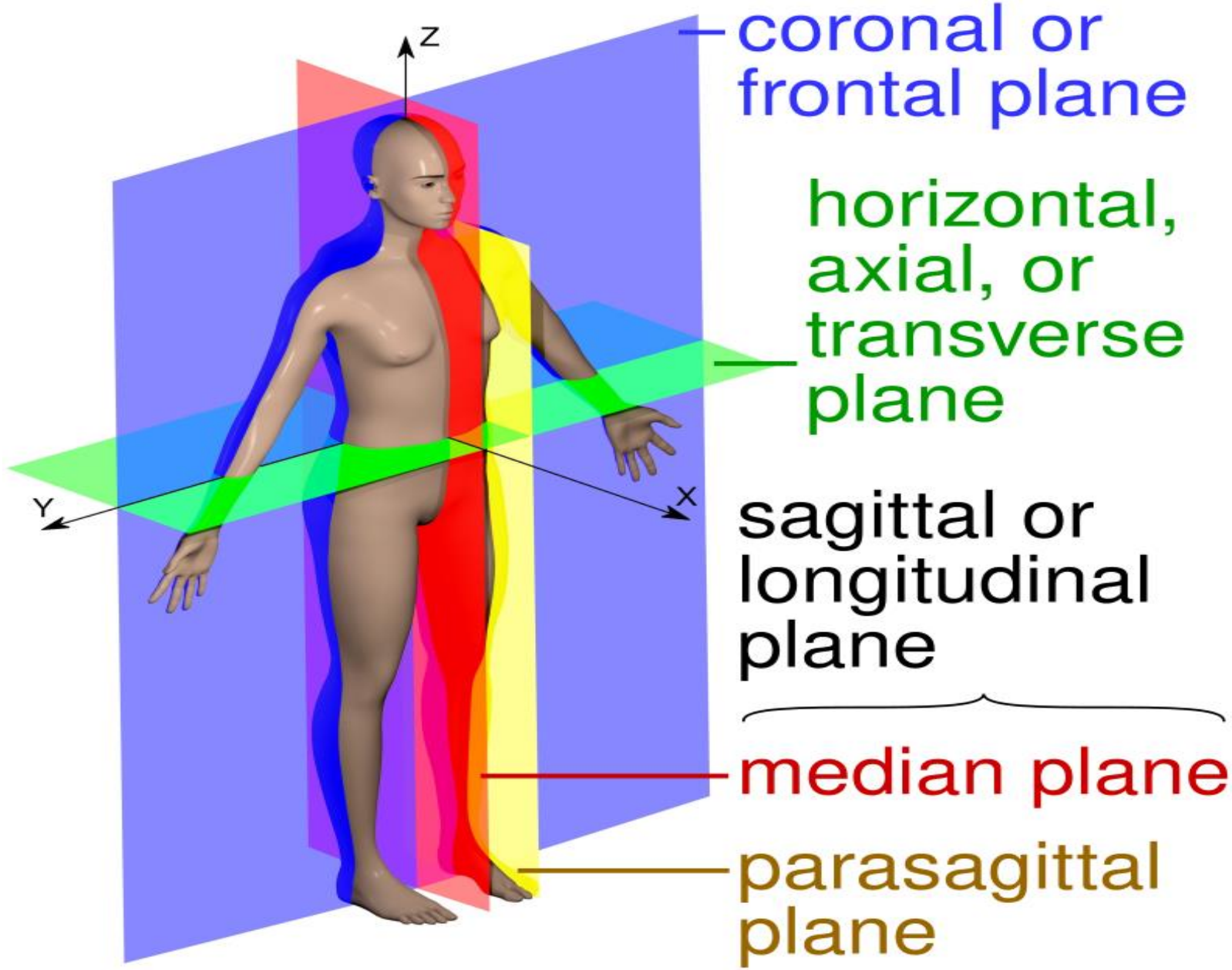
Homologus organs

EMBRYONIC STRUCTURE	Male	Female
Gonads – genital ridge medulla cortex	 Testes -	 - Ovary
Gubernaculum	Ligamentum Testis	Round ligament of uterus
Paramesonephric duct or mullerian duct	Appendix testis and uterus masculinus (remnants)	Oviduct, uterus, cervix, cranial vagina
Mesonephric duct or wolffian duct and body	Efferent tubules, epididymis, vas deferens, ampulla	Paraovarian cyst and gartners duct - remnants
Genital tubercle	Penis	clitoris
Genital folds	Penile urethra	vestibule
Genital swelling	Scrotum	Vulvar lips
Urogenital sinus	Bulbourethral gland and pelvic urethra	Caudal vagina, urethra and vestibular glands

Prepuce----------labia minora

Description of Pelvis

- pelvis composed of the oscoxae laterally and ventrally.
- sacrum and first three coccygeal vertebrae dorsally.
- Genital tract - suspended in the pelvic cavity by the broad ligament. (**inflammation – parametritis**)
- **Mesovarium: Ovary**
- **Mesosalpinx: Fallopian tubes**
- **Mesometrium: Uterus**


Z
Y
X
coronal or frontal plane
horizontal, axial, or transverse plane
sagittal or longitudinal plane
median plane
parasagittal plane

Ovaries

- primary reproductive organs (paired)
- Has both exocrine (ovum release) and endocrine functions
- Single layer of cuboidal/columnar cells - Germinal epitheliums
- This layer covers the entire ovary except in mare, where it is limited to ovulation fossa
- Below germinal epithelium layer is tunica albuginia and then large mass of follicles.
- Blood supply to ovary is by **Utero-ovarian artery**
- Venous drainage by uterine vein which lies close to ovarian artery and for the transfer of luteolytic PGF2α from the Uterus to the Ovary by counter current mechanism.

- **Medulla (inner) - blood vessels and nerves**
- **Cortex** - contains follicles, corpus haemorrhagicum, CL and atretic follicles
- **Mare - the location of cortex and medulla** is **inverted**
- **ovulation fossa** - oocyte is released
- ovarian bursa: pocket formed by the utero-ovarian ligament and mesovarium
- **In Ruminants - right ovary more active while in Mare left**
- **Cortical tubules in Canine Ovary**

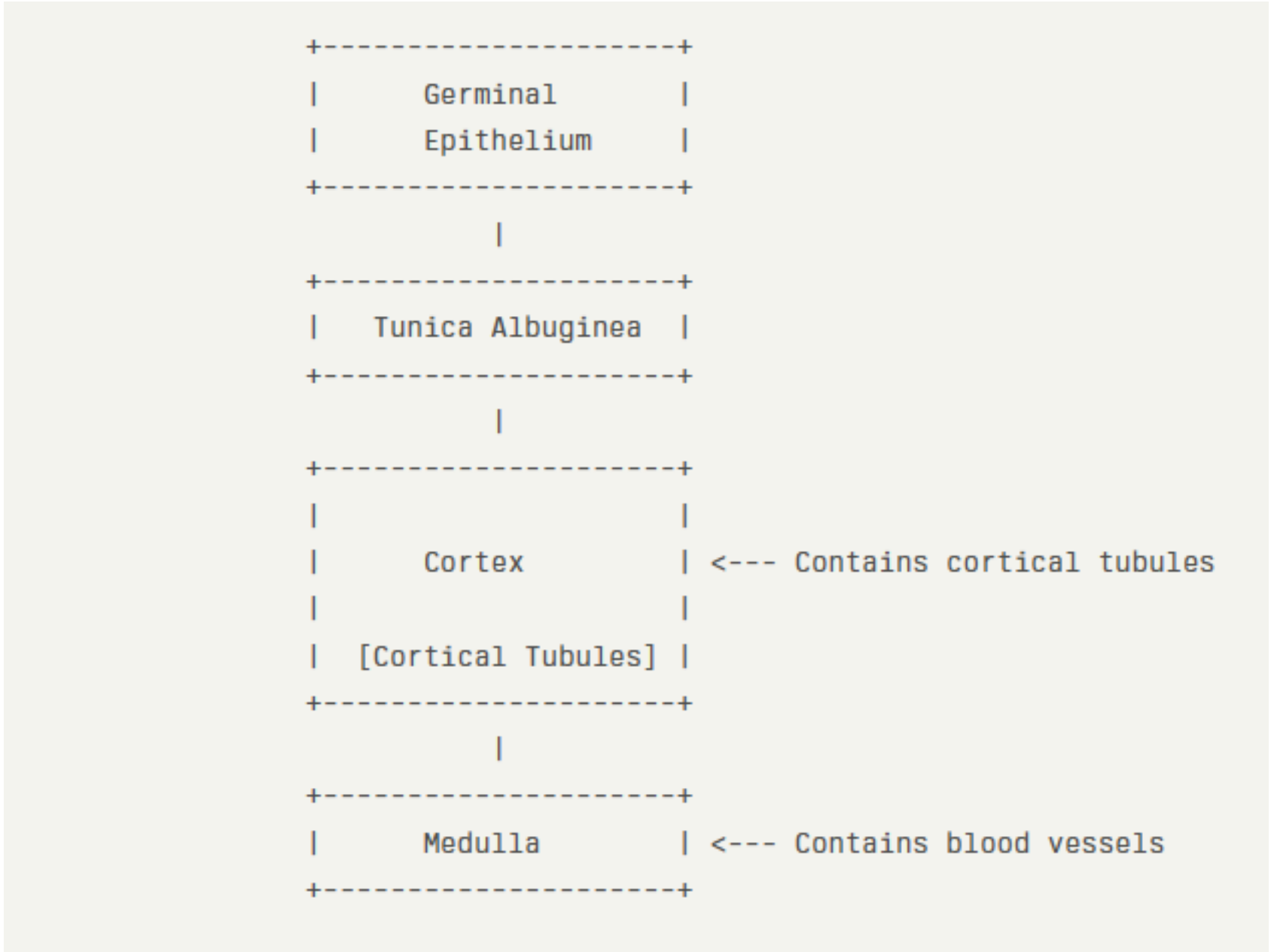
Cow/buffalo : oval/almond shaped

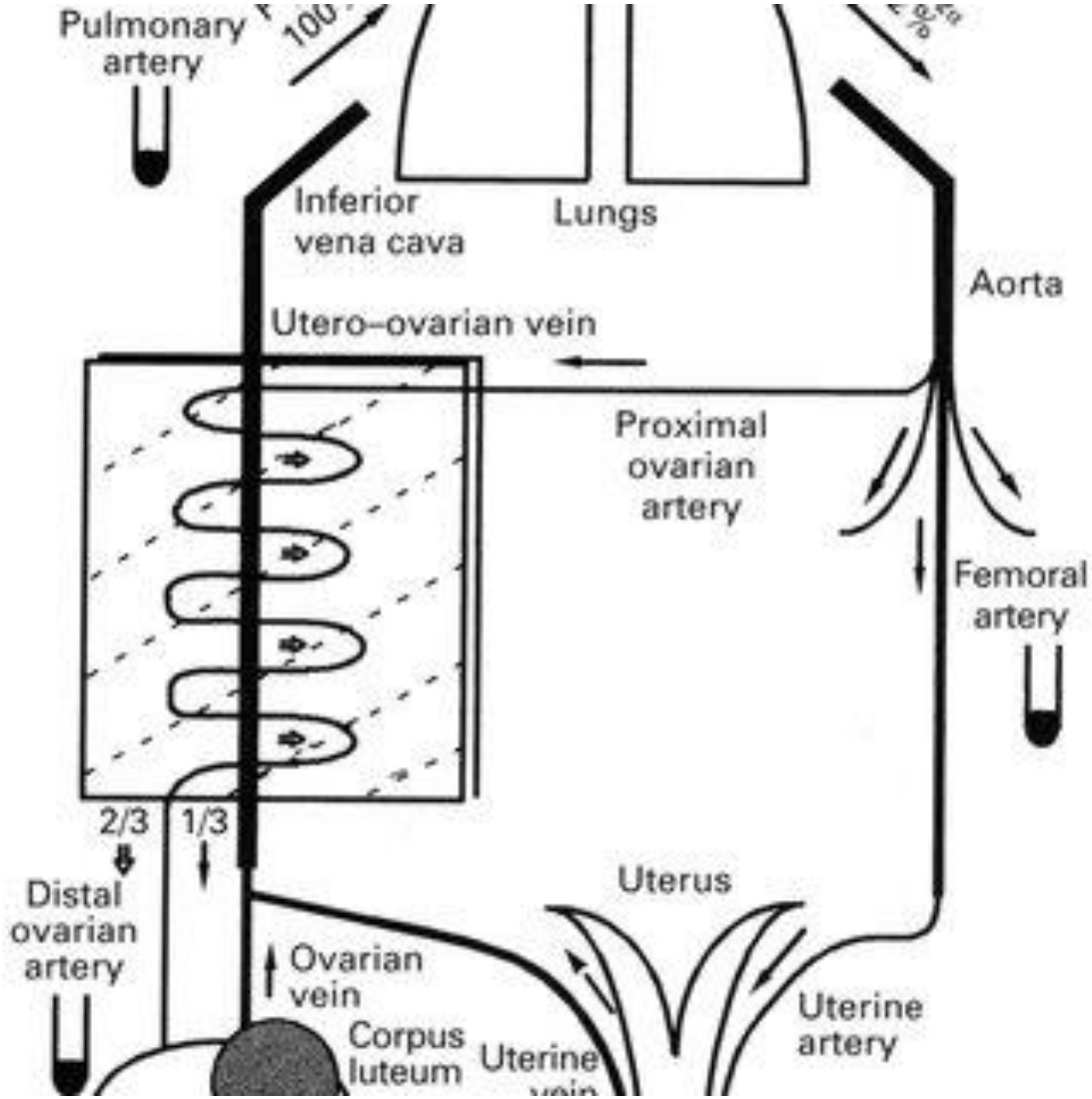
Mare : Bean/kidney shaped

Sheep/Goat : Almond shaped

Bitch/Sow : **Mulberry/bunch** of grapes

Camel : Oval


Germinal Epithelium
Tunica Albuginea
Cortex
[Cortical Tubules]
Medulla
<--- Contains cortical tubules
<--- Contains blood vessels


Pulmonary artery
Inferior vena cava
Lungs
Aorta
Utero–ovarian vein
Proximal ovarian artery
Femoral artery
2/3
1/3
Distal ovarian artery
Ovarian vein
Corpus luteum
Uterine vein
Uterus
Uterine artery

follicles

1. Primodial / Primary follicles
2. Secondary / Growing follicles
3. Tertiary / Vesicular follicles
4. Graffian / Preovulatory follicles
5. Atretic follicles

Follicles

1. **Primary follicles:** surrounded by a **single layer of cuboidal granulosa** (epithelial) **1,50,000 follicles** in fetal ovary – **egg nesting/ resting stage**

- Source of ovum is primodial germ cells from yolk sac which moves to gonads at 40 days of gestation in cattle
- Growth arrested at diplotene stage of prophase I of meiosis I from birth to puberty (Dictyate nucleus)

2. **Secondary / Growing follicles:** surrounded by ≥2 layers of granulosa cells

3. **Tertiary follicle:** fluid filled cavity (**Antrum**) and thecal layers

Graffian follicle Layers:

Outer - Theca externa & Inner -**Theca interna (secretes estrogen hormone)**

Oocyte layer

outer : Corona radiata

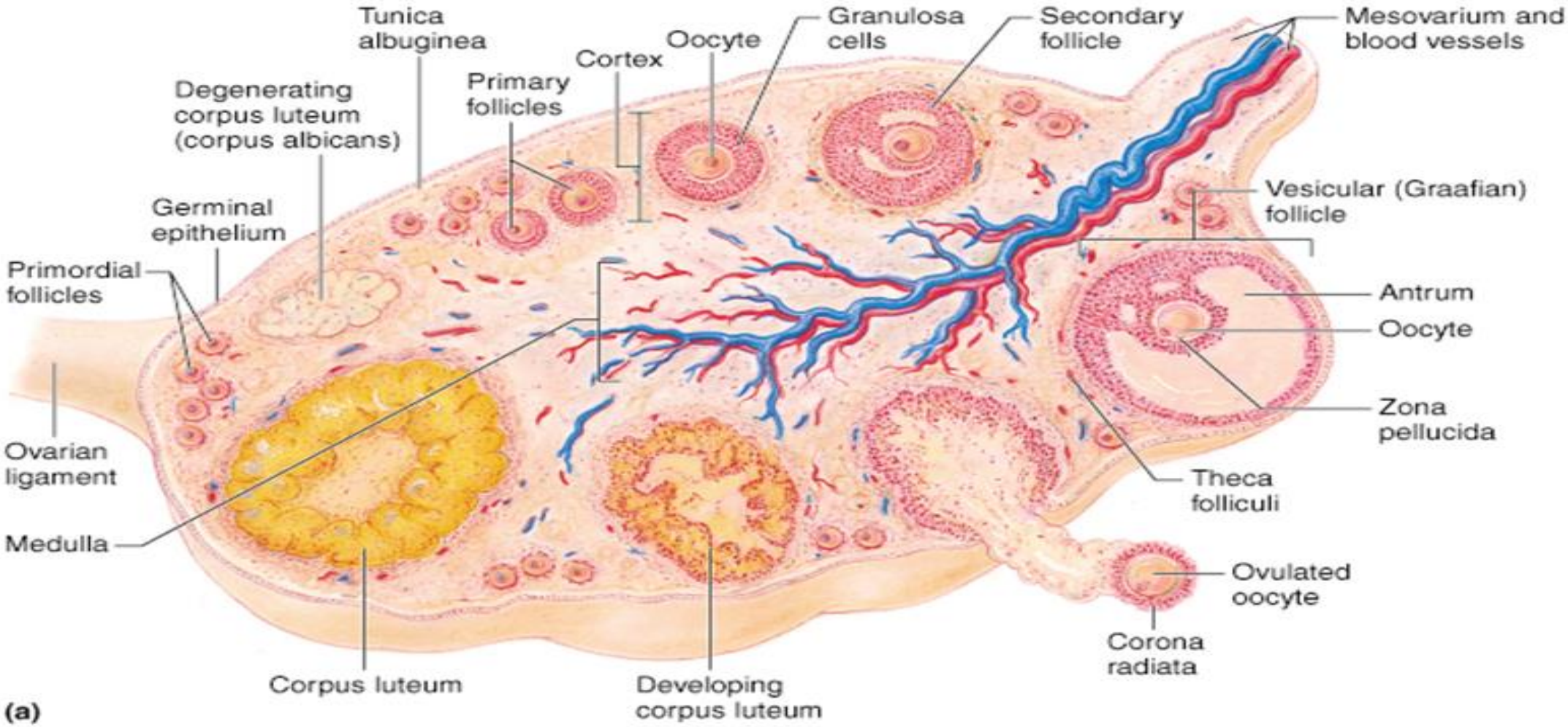
Inner most layer: Zona pellucida

* **cumulous oophorous -** Granulosa cell at the base of ovum on which oocyte rest.

* Germinal vesicle: ovum with large nucleus

* **Atretic follicle**: In each cycle many follicles develop, one grows and ovulates; rest undergo **degeneration** which are Atretic follicle.

*** Liquor folliculi /Follicular fluid :** contains many hormones and enzymes and help in growth and maturation of oocyte

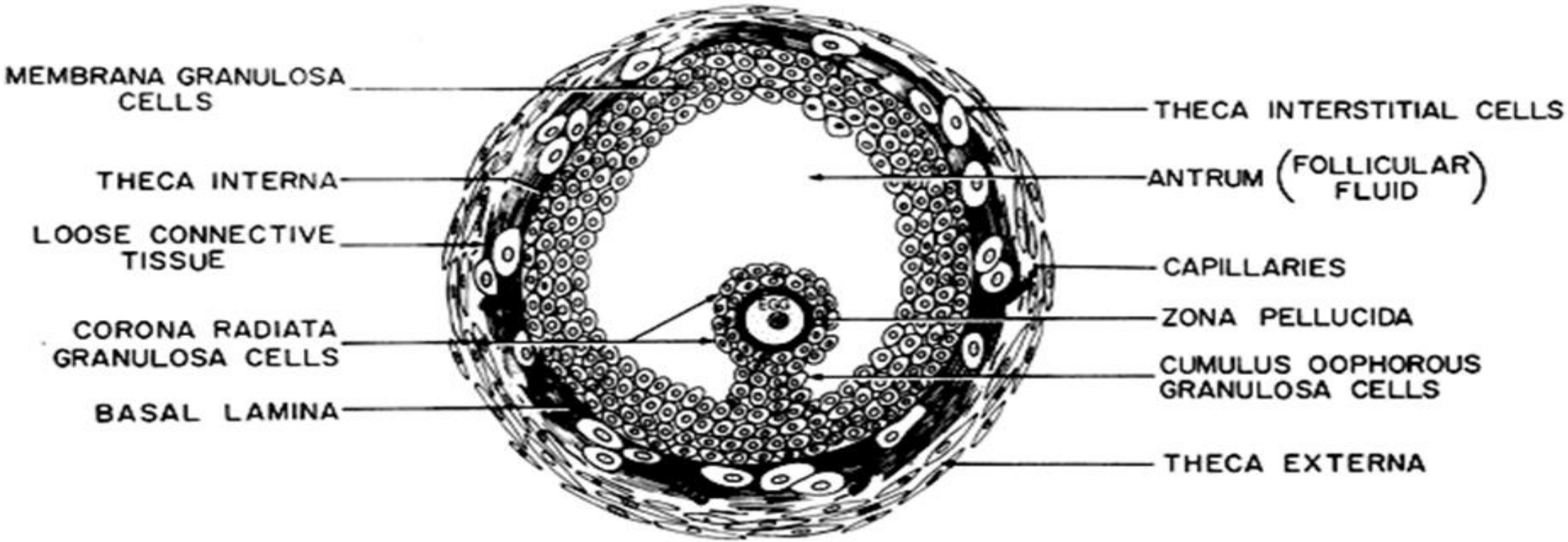


Utero-ovarian artery-Fallopian tubes and anterior parts of uterine horns

Middle uterine artery: Posterior parts of uterine horns and anterior part of body of uterus

Caudal uterine artery: Posterior part of body of uterus to anterior part of vagina

- Size of Graffian follicle:
- Cattle: 12-20mm
- Buffalo: 10-12mm



Corpus luteum (CL):

- It is rich in blood supply.
- Contains 2 types of cells
- **a) Large lutein cells: from granulosa cells**
- **b) Small lutein cells: from theca cells**
- Maximum size is attained on day 15-16 of estrous cycle.
- After day 16, CL regress and P4 level drop simultaneously.
- **yellow coloured - in cow and mare (mare – cauliflower shape)**
- **grey coloured in bitch and** sow

Corpus Haemorrhagicum(CH): **freshly formed CL**

CL Spurium : It is **CL of estrous cycle (Cyclic CL).**

CL Albicans : After regression of CL a hard, **scar like structure** is left. It is **white coloured** body (White body). Their number gives the number of calves born during postmortem

CL Verum: CL of pregnancy

Monotocus species: **single ovulation single offspring** e.g. Mare, cattle, buffalo

Polytocus species: **have multiple ovulations, many offsprings** e.g. Bitch, sow.

Monoestrus species : exhibit one estrous cycle which is followed by a period of **long anestrous** e.g bitch

Polyestrous spp: exhibit continuous **regular estrous cycles** through the year e.g. Cattle, buffalo. Buffalo is basically a polyestrous animal but shows summer anestrous.

Seasonal Polyestrous : estrous cycles in a particular season of the year e.g. Mare, sheep and goat. (because of melatonin secreted from Pineal gland)

- **Mare is long day breeder**
- **Sheep & goat are short day breeders**.

OVIDUCTS (Fallopian tubes/Salpinges): Salpingitis

From ovary to the tip of uterine horn

In mare and cow, the oviducts are about 20 to 30 cm long while in the sow it is 15 to 18 cm

Parts

- Infundibulum (towards ovarian end) - **fimbria for capturing** the ova following ovulation
- Ampulla
- isthmus(towards uterus)
- **Site of fertilization: Ampullary isthmic junction**

UTERUS

- uterine body and two uterine horns.

A). Bicornuate uterus - cow, buffalo, sow, bitch, doe and ewe

- **small uterine body and two long uterine horns**
- **Largest uterine horns - sow.**
- **Caruncles** - Ruminant uterus has mushroom like non-glandular projection and arranged in **two dorsal and two ventral rows**
- **Cattle 70-120, Buffalo 60-90 and Sheep 88-96**

B). Bipartite uterus - Mare

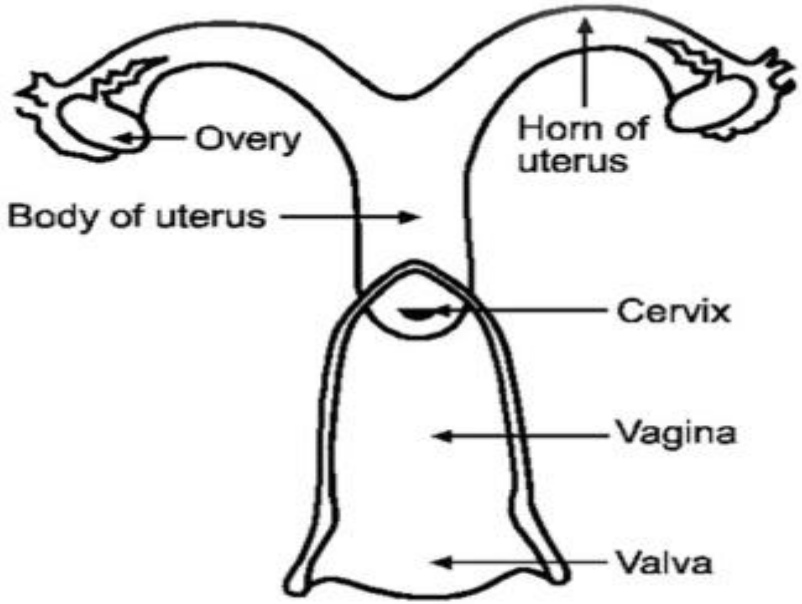
prominent body and shorter horns - T-shaped

C). Simple/Simplex uterus: primates – human

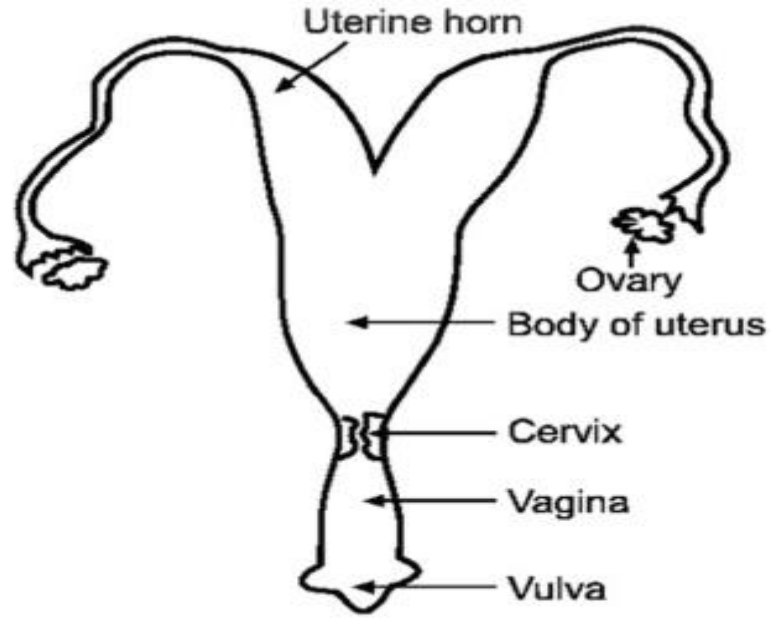
uterus - pear shaped body with no uterine horn

D). Duplex uterus: **Rat, Rabbit, Guinea Pig**

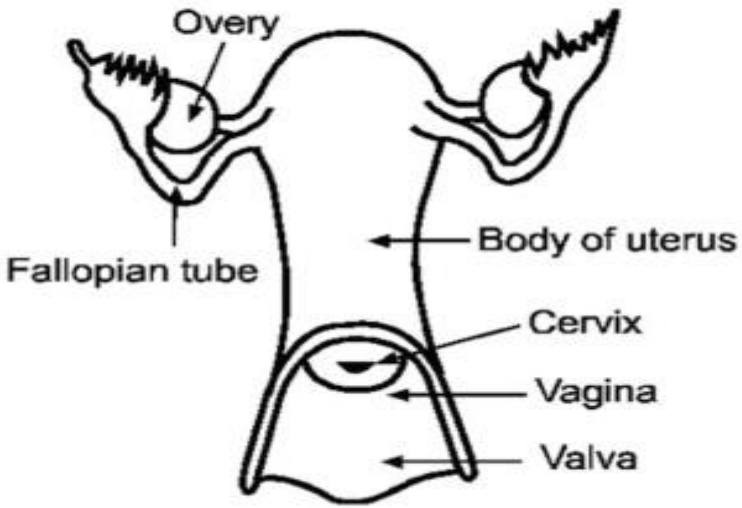
Uterus with two uterine horns each with a separate cervical canal which opens into vagina



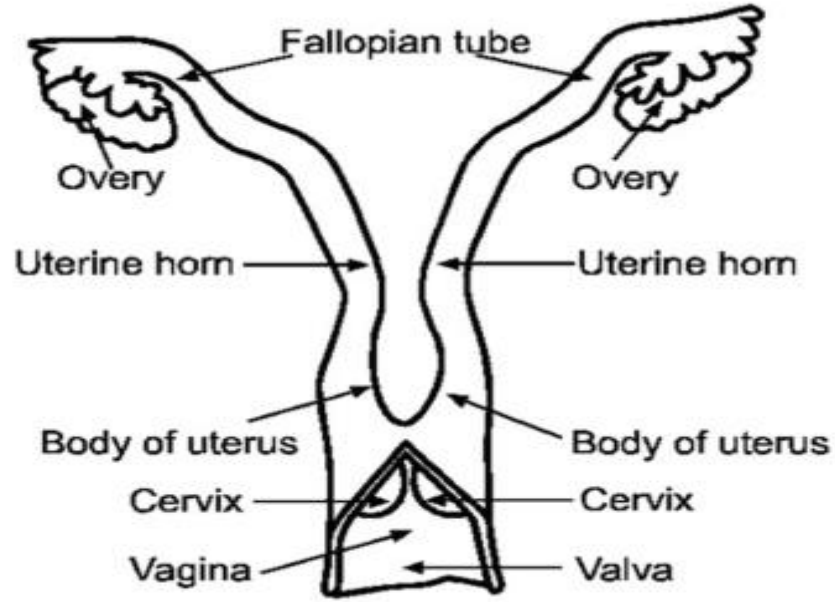
A. Bicornuate uterus



B. Bipartite uterus



C. Simplex



D. Duplex

- **Main functions of uterus:**

a) Gamete transport and capacitation:

contractions of smooth muscles

b). **Implantation and Gestation**

embryo takes nutrition from uterine glands of uterus and the secretion of these glands is known as **Uterine milk/Histotroph.**

c). Luteolytic functions:

Synthesis of $PGF_{2\alpha}$ which is responsible for luteolysis.

CERVIX – Cervicitis – cervcial mucosa contains IgA and IgG

- **annular rings** - in cow, buffalo, doe and ewe **3-5 in cattle and 1-3 (mostly only 2) in buffalo**
- In bitch - cervix is poorly defined
- Sow : **cork screw like cervix**
- **Fornix vagina** - luminal **space a**round the **external os**

VAGINA

- mucosal layer of the vagina is composed of **stratified squamous epithelial cells** and become **cornified under the influence of estrogen**
- At floor of vagina two ducts of **Canals of Gartner** (remnants of the primitive mesonephric or Wolffian ducts)

Vulva: external genitalia which consist of vestibule, clitoris and vulvar lips

Vestibular or Bartholin's glands- two in number and located on either side in the constrictor muscles of the vestibule and open in vagina

Estrus is the period during reproductive cycle when female animals become **sexually accessible.**

Estrous cycle - time interval between two estrus periods.

Cow/Buffalo	21 days
Mare:	21 days
Ewe:	**17 days**
Doe:	21 days
Sow:	21 days
Bitch:	**16-56 weeks**
Queen:	**2-3 weeks**

Progesterone - main hormone regulating the estrous cycle

standing heat – allow herd mate to mount on her

arborization/crystallization of mucus - **fern pattern of** cervical mucus due to **high chloride due to elevated estrogen**

STAGES OF ESTROUS CYCLE

Follicular phase - Proestrus+Estrus

Luteal Phase **-** Metestrus+Diestrus

Luteal Phase

CL – Progesterone - **negative feedback on hypothalamus** and pituitary it inhibits release of gonadotrophins

Endometrium - $PGF_{2\alpha}$ - Regression of CL (day 17-18) – P4 level down - negative feedback cease

Follicular Phase

GnRH - acts on anterior pituitary - FSH, LH

FSH – ovary - growth of follicles – large follicle – **estrogen -** LH surge – ovulation – formation of CL

Proestrus

- It starts with regression of previous CL.
- follicular growth will be there.
- **Uterus - tonic, turgid and edematous**.
- **Progesterone is low**
- **estrogen is high**.
- **Bleeding in bitch**