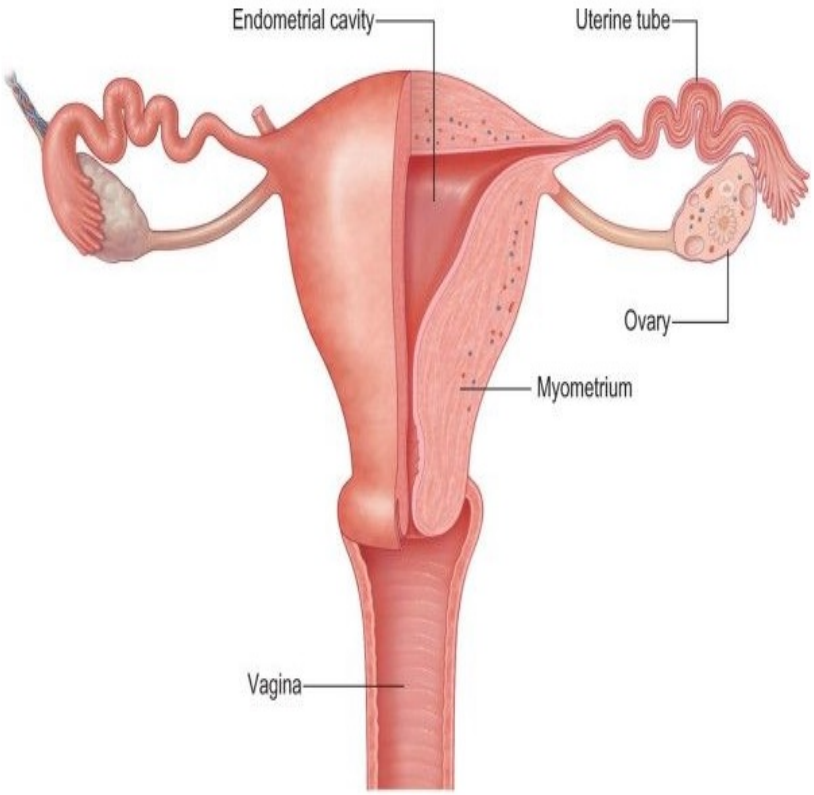
UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

- **HUMAN ANATOMY**

- **Female Reproductive System**



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Introduction

Organs of the Female Reproductive System

- **External Genitalia**

- Consists of the **vulva**
- Vulva has:

1. **Labia majora**
2. **Labia minora enclosing a space called vestibule**
3. **Clitoris**
4. **Greater vestibular glands (Bartholin's glands)** which open into the vestibule

- In the vestibule, there are 2 openings:

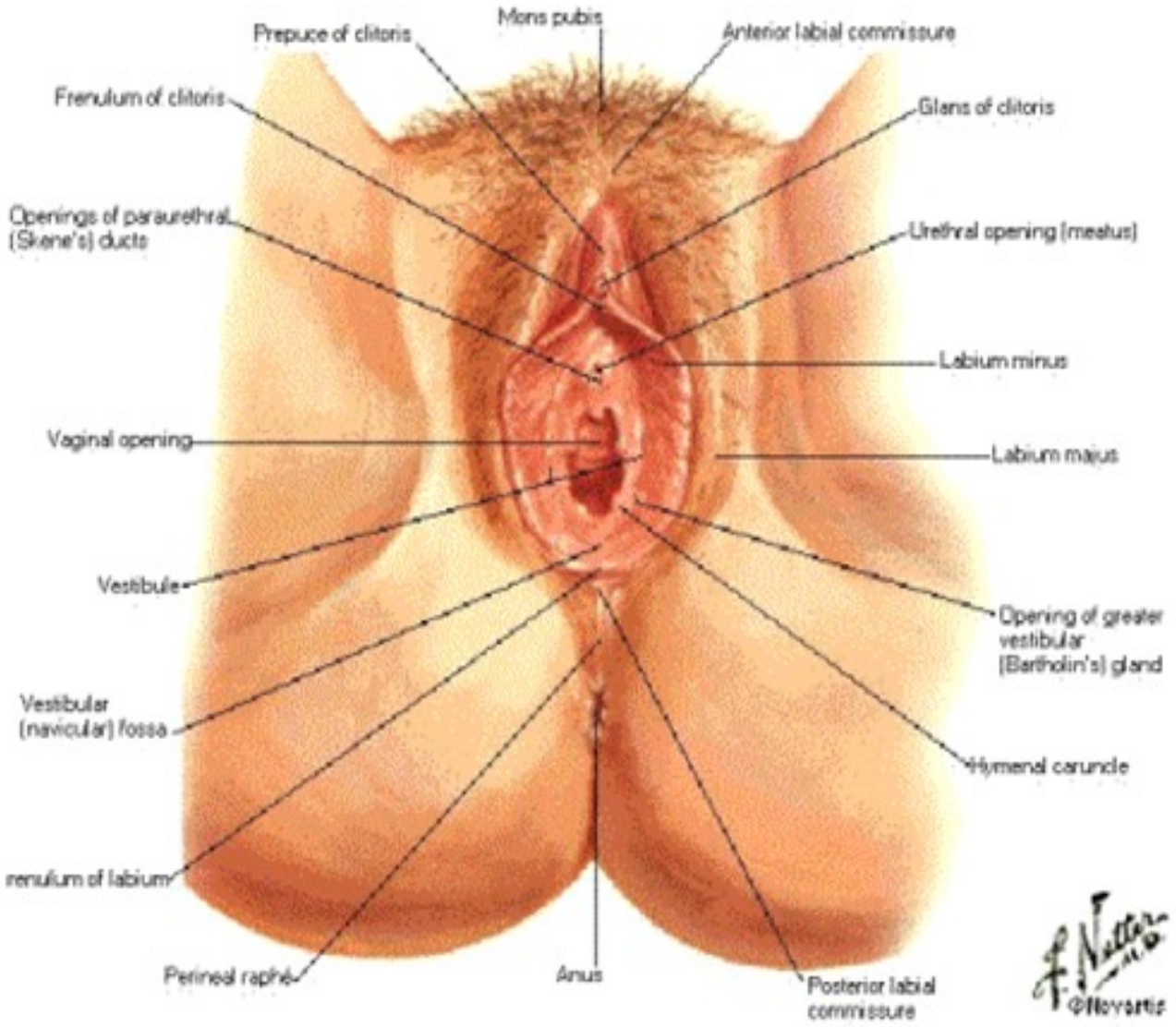
i. Anteriorly: urethra

ii. Posteriorly: vagina

- **Internal Genitalia**

1. **Vagina**
2. **Uterus**
3. **Uterine tubes (fallopian tubes)**
4. **Ovaries**

Female External Genitalia



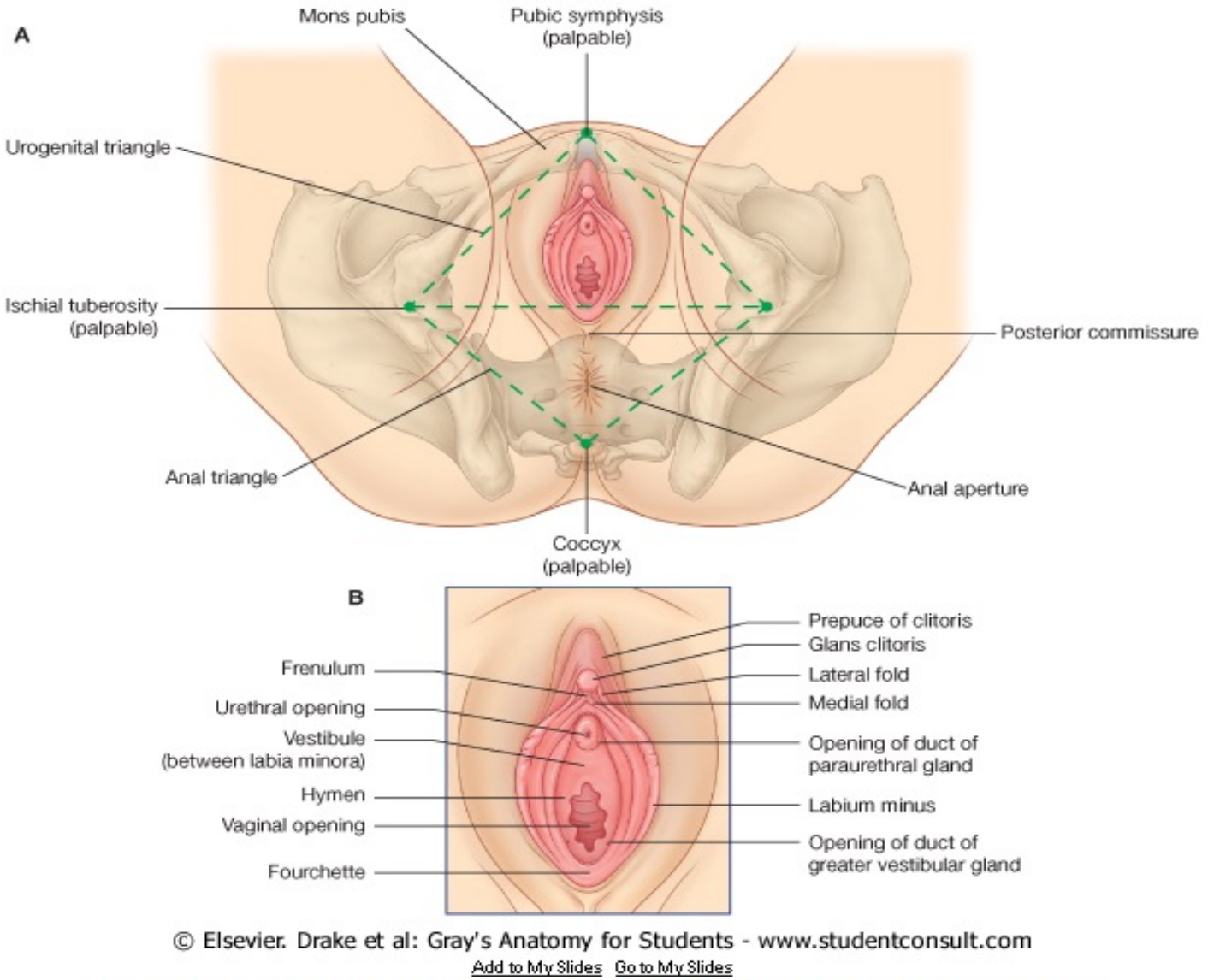
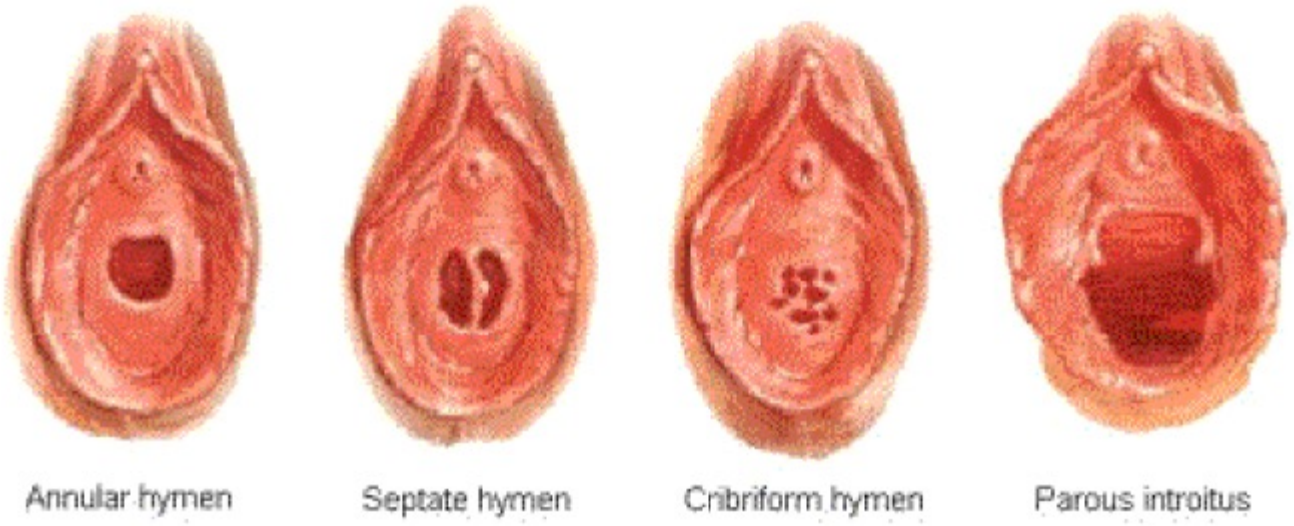


Figure 5.73 Superficial features of the perineum in women. **A.** Overview. **B.** Close-up of external genitalia.

Perineum and External Genitalia of Female [Continued]



Functions of Female Reproductive System

1. Produces the female gametes (oocytes), a process called **oogenesis**
2. Provides the environment for fertilization to form the zygote
3. Holds the embryo during its complete development through the fetal stage until birth
4. Ovaries produce steroidal sex hormones that control organs of the reproductive system and influence other organs

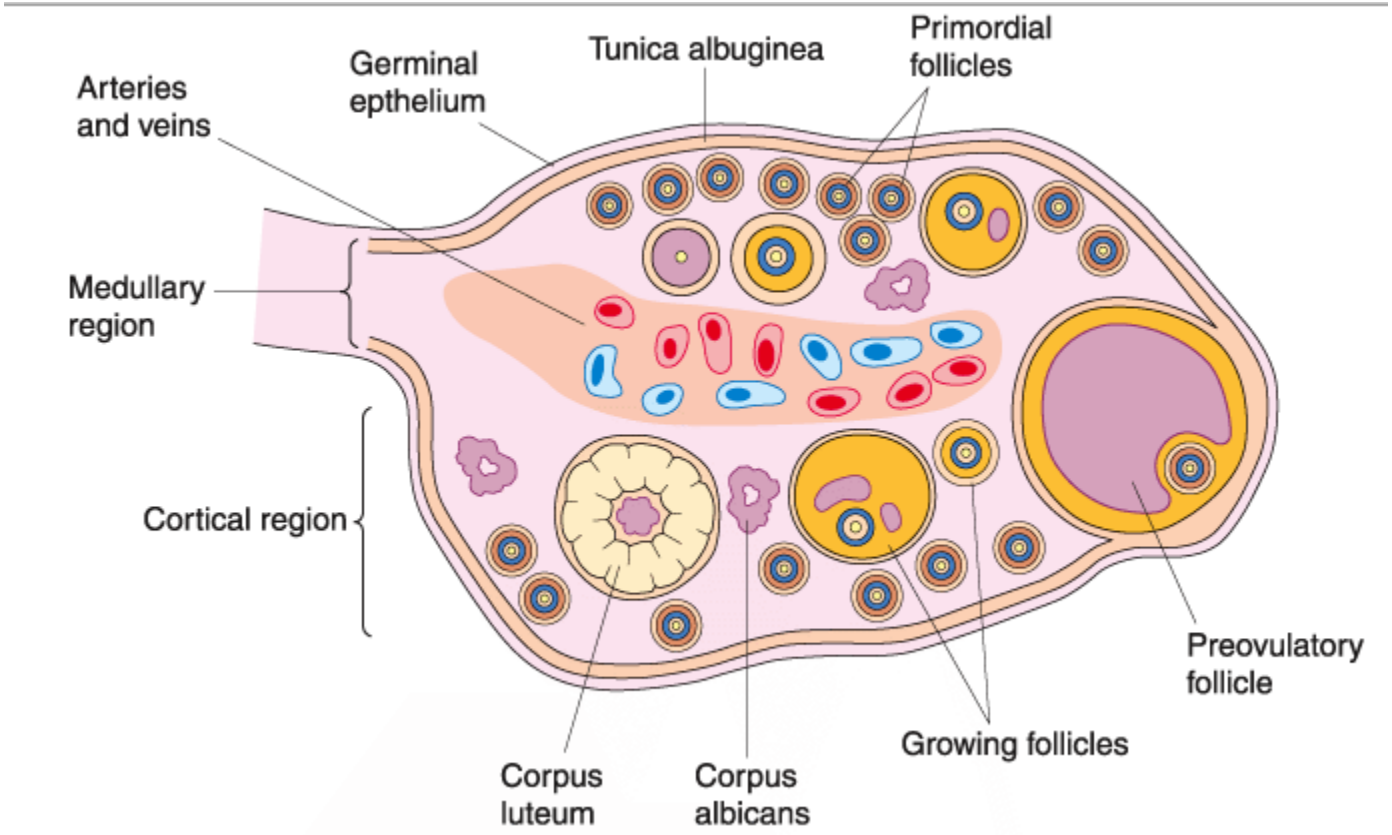
- Beginning at menarche (first menses), this system undergoes monthly changes in structure and function that are controlled by neurohormonal mechanisms (menstrual cycles)
- Menopause is a variably timed period during which the cyclic changes become irregular and eventually disappear
- In the postmenopausal period, the reproductive organs slowly involutes

Ovaries

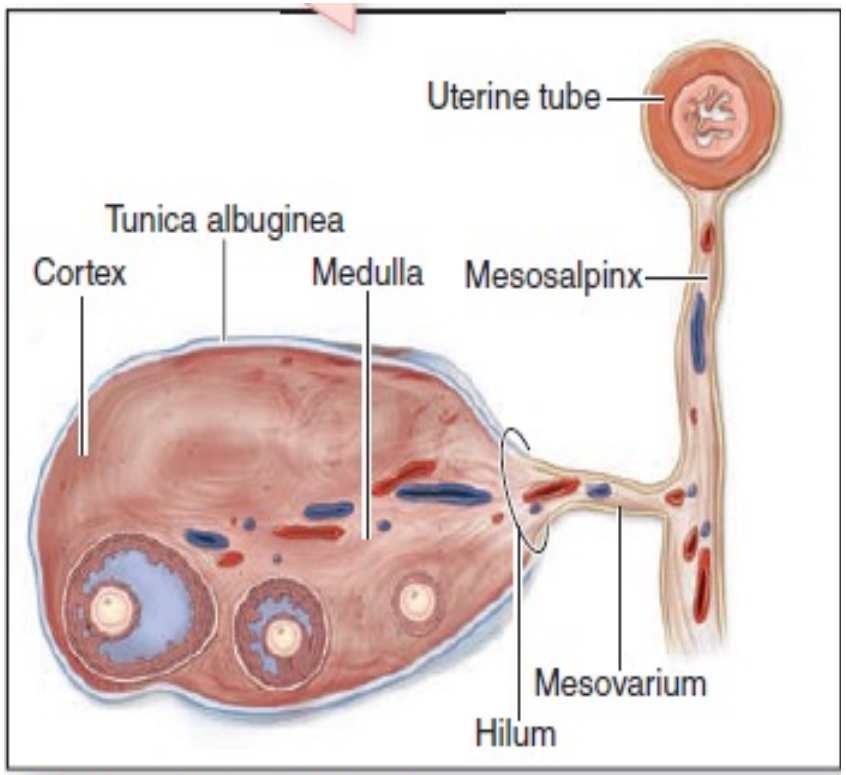
- Almond-shaped bodies (3x1.5x1 cm)
- Located in ovarian fossa bounded by:
  - ***Anterior: broad ligament***
  - ***Posterior: ureter and internal iliac vessels***
  - ***Superior: external iliac vessels***
  - ***Passing via the fossa: obturator nerve and vessels***
- Each ovary is covered by a simple cuboidal epithelium called the **germinal epithelium**
- Germinal epithelium is continuous with the mesothelium
- It overlies a layer of dense connective tissue capsule called **tunica albuginea** like that of the testis
- Under the tunica albuginea, each ovary has from outside to inside:

1. **Cortex**
2. **Medulla**

Ovaries


Arteries and veins
Germinal epthelium
Tunica albuginea
Primordial follicles
Medullary region
Cortical region
Preovulatory follicle
Growing follicles
Corpus luteum
Corpus albicans

Ovaries



(b) Lateral sectional view

Functions of Ovaries

1. Production of oocytes (female gametes)

- Oocyte is viable for about 12-24hrs

2. Production of hormones: **oestrogen** by follicular cells (follicles) and **progesterone** by the luteal cells (corpus luteum)

Uterine tubes

- Also called **fallopian tubes or oviducts**
- Are tortuous and convey oocyte from ovary to uterus
- Spermatozoa introduced into the vagina pass up into the uterus, and from there into the uterine tubes
- Fertilization usually takes place in the lateral part of the tube
- Each tube is about 10cm long

Parts of the Uterine Tubes

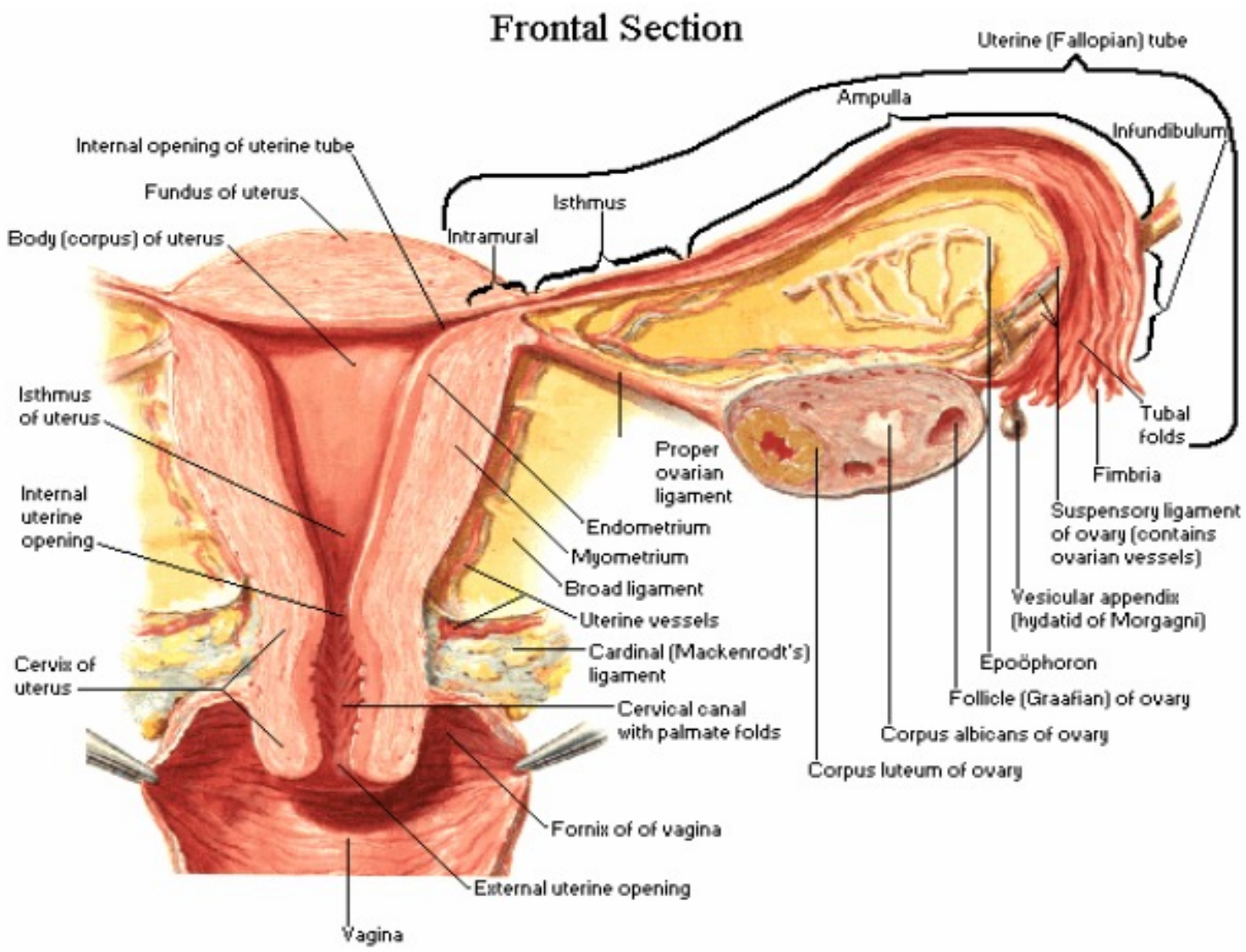
- Has 4 parts

1. **Infundibulum**

- Is the lateral end of the uterine tube and is funnel shaped
- Bears a number of finger-like processes called fimbriae, thus is the fimbriated end

2. **Ampulla**

- Part medial to the infundibulum
- Is thin-walled, dilated and tortuous
- Forms approximately 2/3rd or 6-7cm of the tube
- Is about 4mm in diameter
- Fertilization usually takes place here


Frontal Section
Uterine (Fallopian) tube
Ampulla
Infundibulum
Internal opening of uterine tube
Fundus of uterus
Body (corpus) of uterus
Isthmus
Intramural
Isthmus of uterus
Internal uterine opening
Cervix of uterus
Proper ovarian ligament
Endometrium
Myometrium
Broad ligament
Uterine vessels
Cardinal (Mackenrodt's) ligament
Cervical canal with palmate folds
Fornix of of vagina
External uterine opening
Vagina
Tubal folds
Fimbria
Suspensory ligament of ovary (contains ovarian vessels)
Vesicular appendix (hydatid of Morgagni)
Epoöphoron
Follicle (Graafian) of ovary
Corpus albicans of ovary
Corpus luteum of ovary

3. **Isthmus**

- Succeeds the ampulla
- Is narrow, rounded and cord-like, and forms approximately the medial 1/3rd or 2-3cm of the tube

4. **Uterine or intramural or interstitial**

- Is about 1cm long and lies within the wall of the uterus
- Opens at the superior angle of the uterine cavity by a narrow uterine ostium

The Uterus

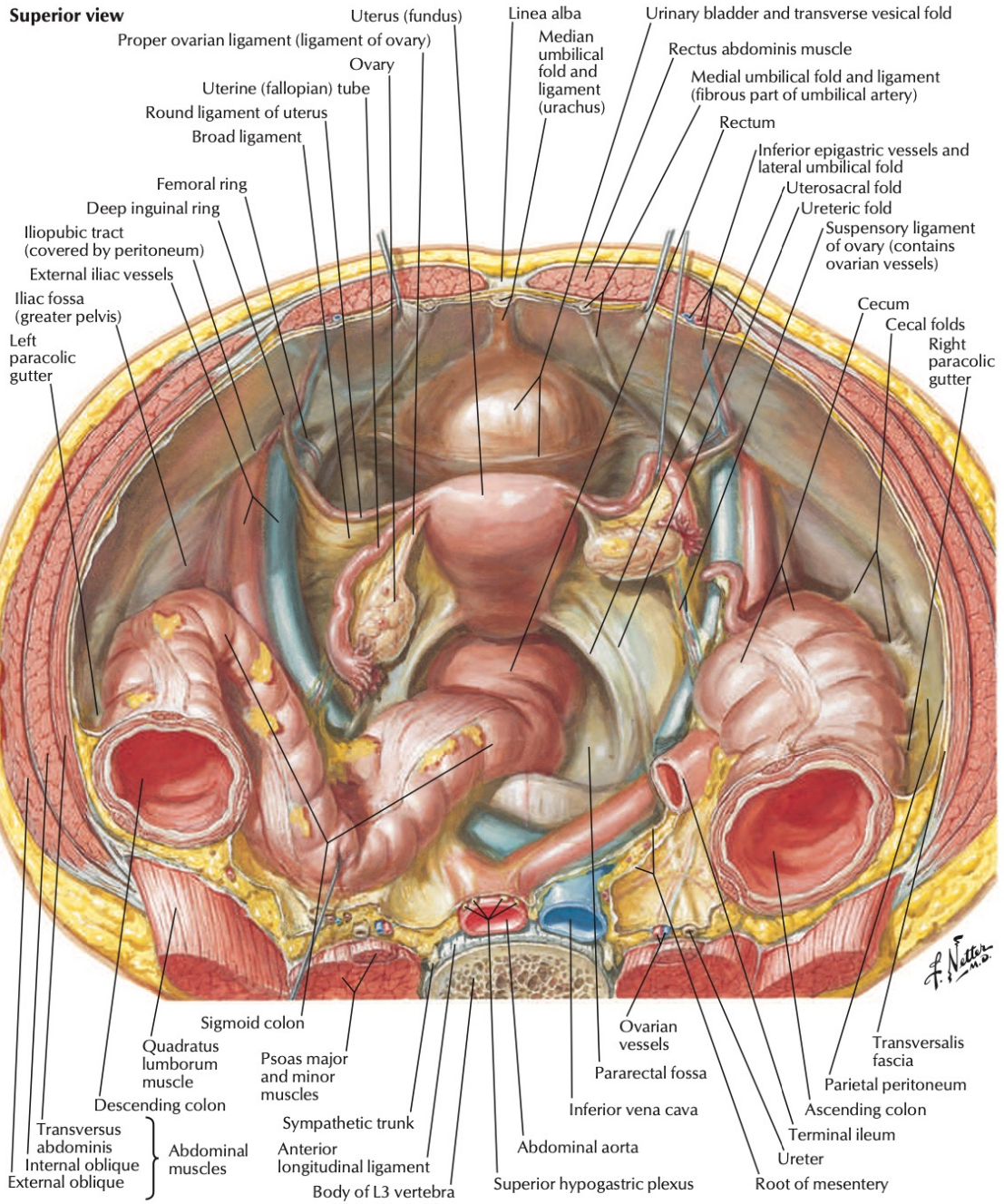
- In layman's language called womb
- Also called **hystera**, on which the word **hysterectomy** is based
- Situated in pelvis between urinary bladder anteriorly and rectum posteriorly
- Though hollow, it is thick walled and firm
- Can be palpated bimanually during a PV (per vaginum) examination
- Is an organ which protects and provides nutrition to a fertilized ovum, enabling it to grow into a fully formed fetus
- At the time of child-birth or parturition contractions of muscle in the wall of the organ result in expulsion of the fetus from the uterus

Size and Shape of Uterus

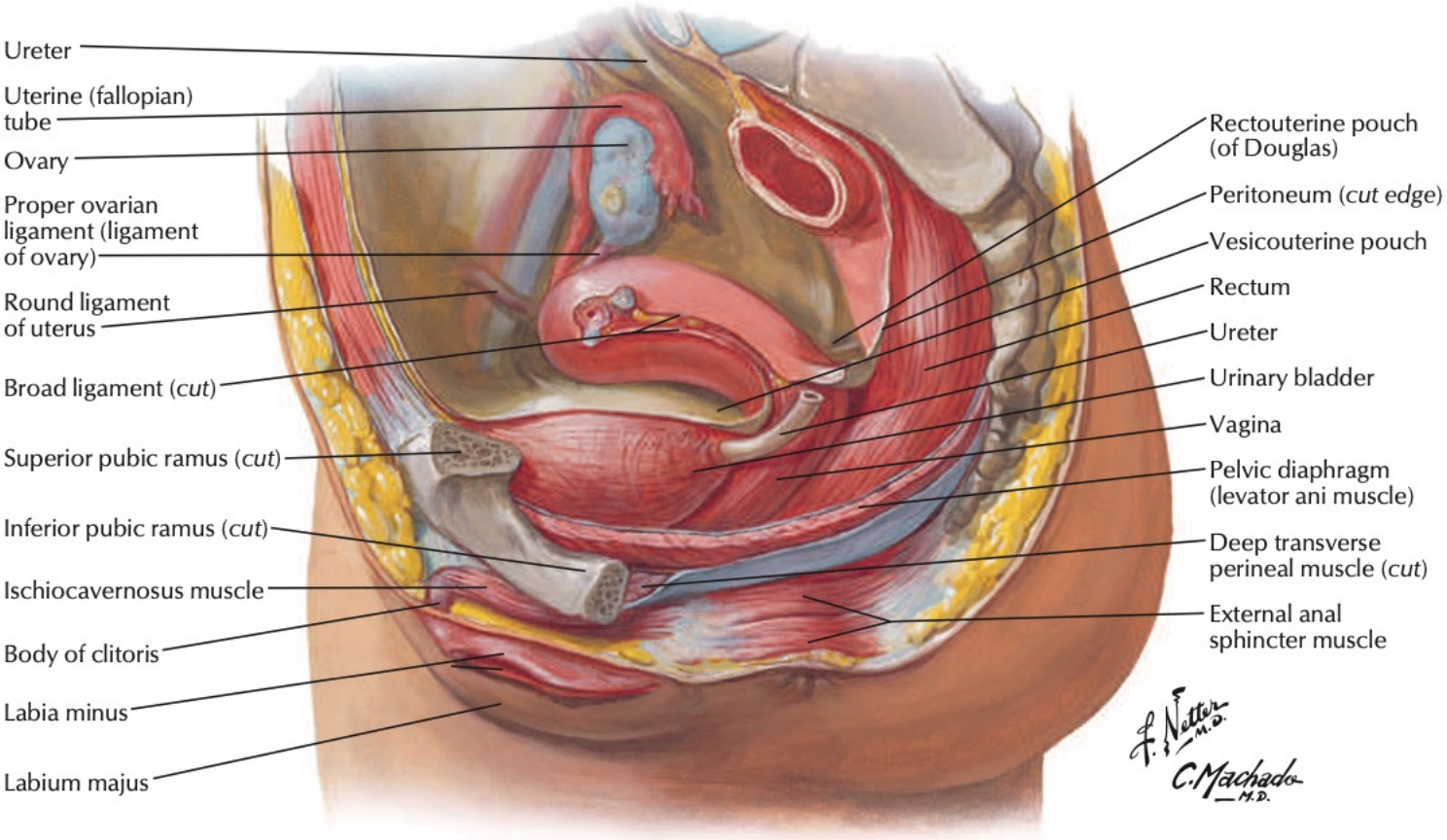
- Is pear-shaped (pyriform)
- About 7.5cm long, 5cm broad and 2.5cm thick
- Weighs 30-40 grams
- Divisions: 2 parts

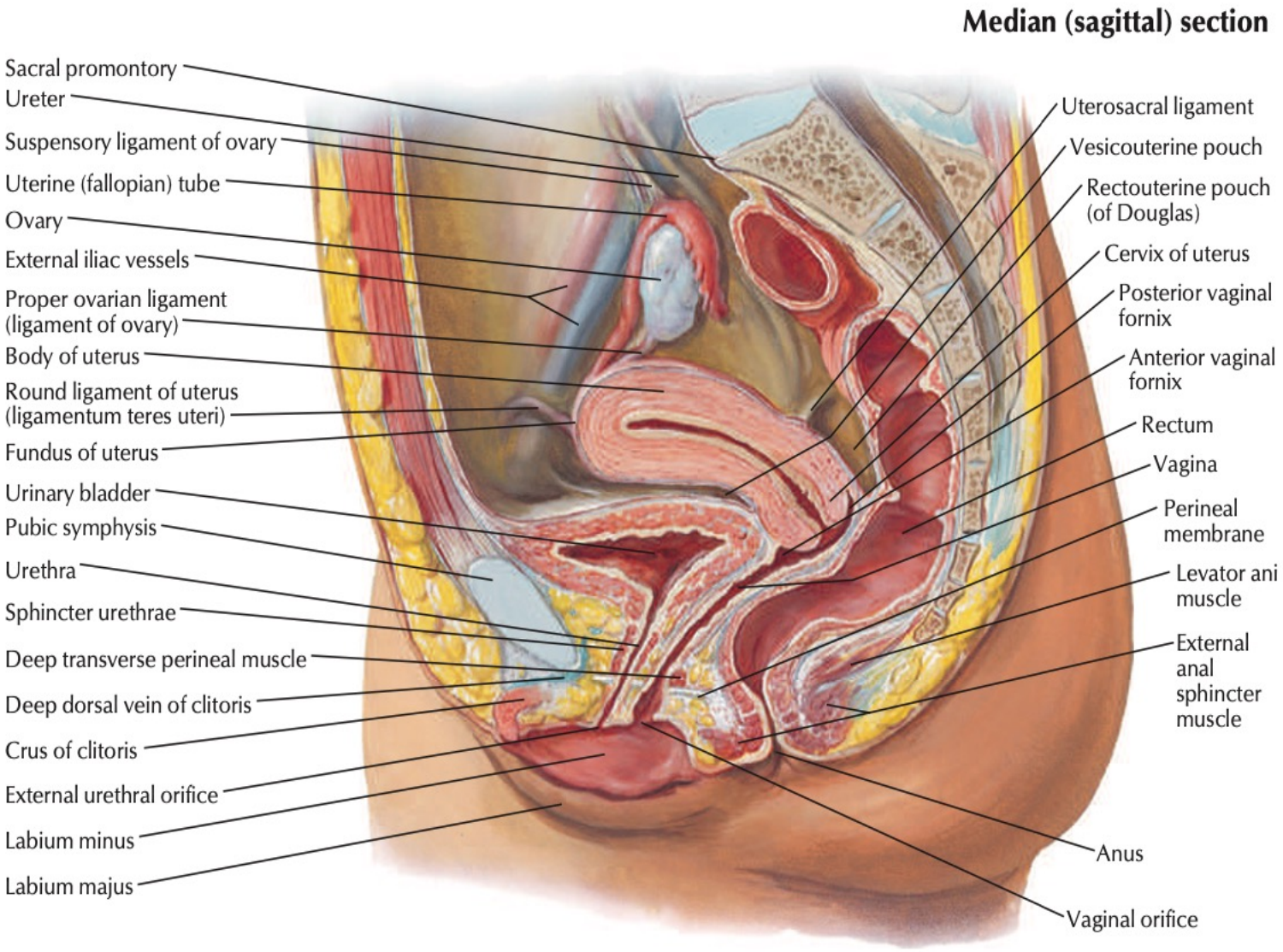
- **Body or Corpus**: upper expanded part and forms 2/3rd of the organ. Dome-shaped part of the uterus is called the fundus
- **Cervix**: lower cylindrical part and forms 1/3rd of the organ

- Body lies above a narrowing of the uterine cavity (**the internal os**), and the **cervix,** lies below the internal os

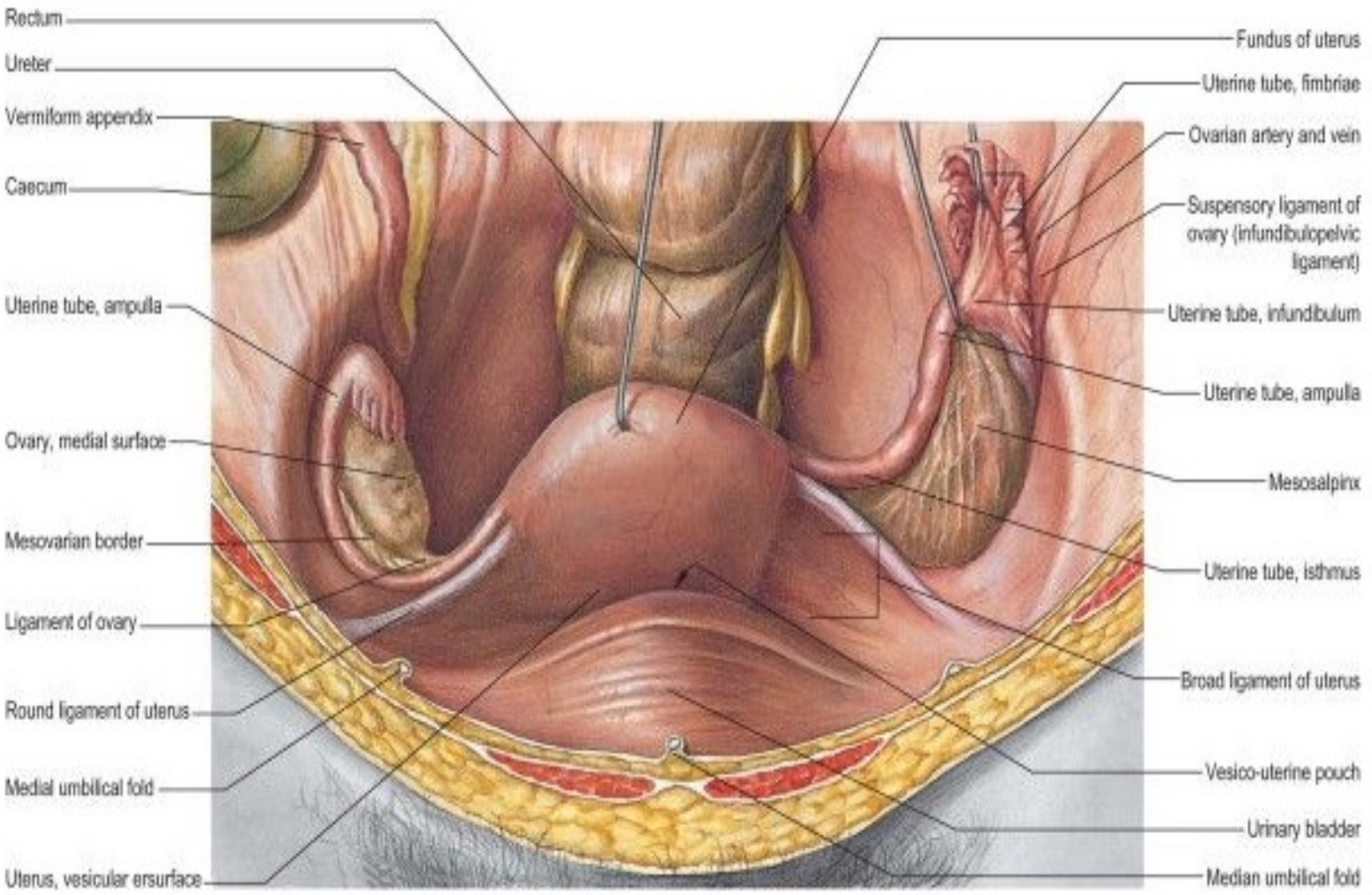

Superior view
Uterus (fundus)
Linea alba
Urinary bladder and transverse vesical fold
Proper ovarian ligament (ligament of ovary)
Median umbilical fold and ligament (urachus)
Rectus abdominis muscle
Ovary
Medial umbilical fold and ligament (fibrous part of umbilical artery)
Uterine (fallopian) tube
Rectum
Round ligament of uterus
Broad ligament
Inferior epigastric vessels and lateral umbilical fold
Femoral ring
Uterosacral fold
Deep inguinal ring
Ureteric fold
Iliopubic tract (covered by peritoneum)
Suspensory ligament of ovary (contains ovarian vessels)
External iliac vessels
Cecum
Iliac fossa (greater pelvis)
Cecal folds
Left paracolic gutter
Right paracolic gutter
Sigmoid colon
Ovarian vessels
Transversalis fascia
Quadratus lumborum muscle
Psoas major and minor muscles
Pararectal fossa
Parietal peritoneum
Descending colon
Inferior vena cava
Ascending colon
Sympathetic trunk
Terminal ileum
Transversus abdominis
Abdominal aorta
Internal oblique
Abdominal muscles
Anterior longitudinal ligament
Ureter
External oblique
Body of L3 vertebra
Superior hypogastric plexus
Root of mesentery

Paramedian (sagittal) dissection

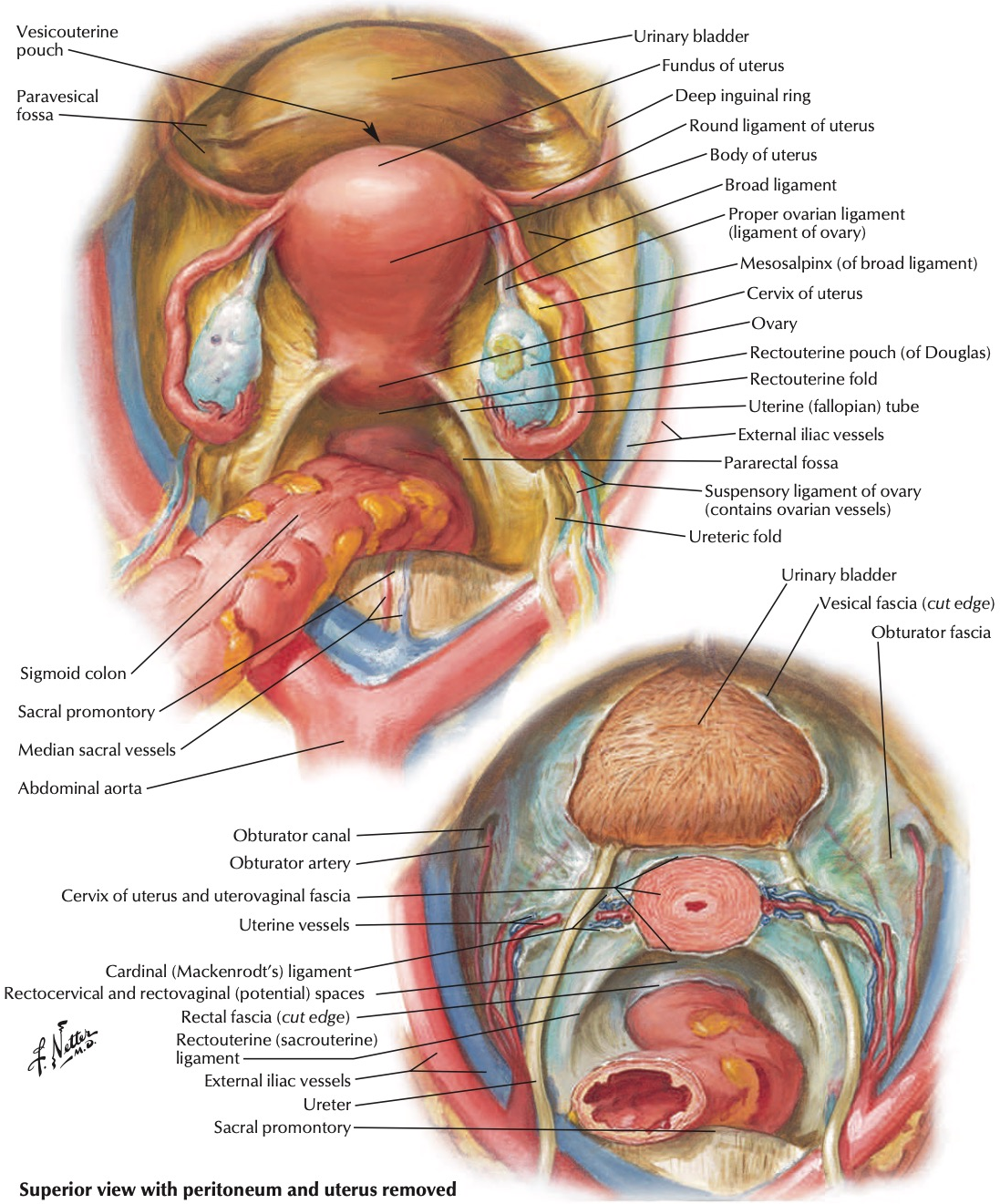



Median (sagittal) section
Sacral promontory
Ureter
Suspensory ligament of ovary
Uterine (fallopian) tube
Ovary
External iliac vessels
Proper ovarian ligament (ligament of ovary)
Body of uterus
Round ligament of uterus (ligamentum teres uteri)
Fundus of uterus
Urinary bladder
Pubic symphysis
Urethra
Sphincter urethrae
Deep transverse perineal muscle
Deep dorsal vein of clitoris
Crus of clitoris
External urethral orifice
Labium minus
Labium majus
Uterosacral ligament
Vesicouterine pouch
Rectouterine pouch (of Douglas)
Cervix of uterus
Posterior vaginal fornix
Anterior vaginal fornix
Rectum
Vagina
Perineal membrane
Levator ani muscle
External anal sphincter muscle
Anus
Vaginal orifice

Female Internal Pelvis



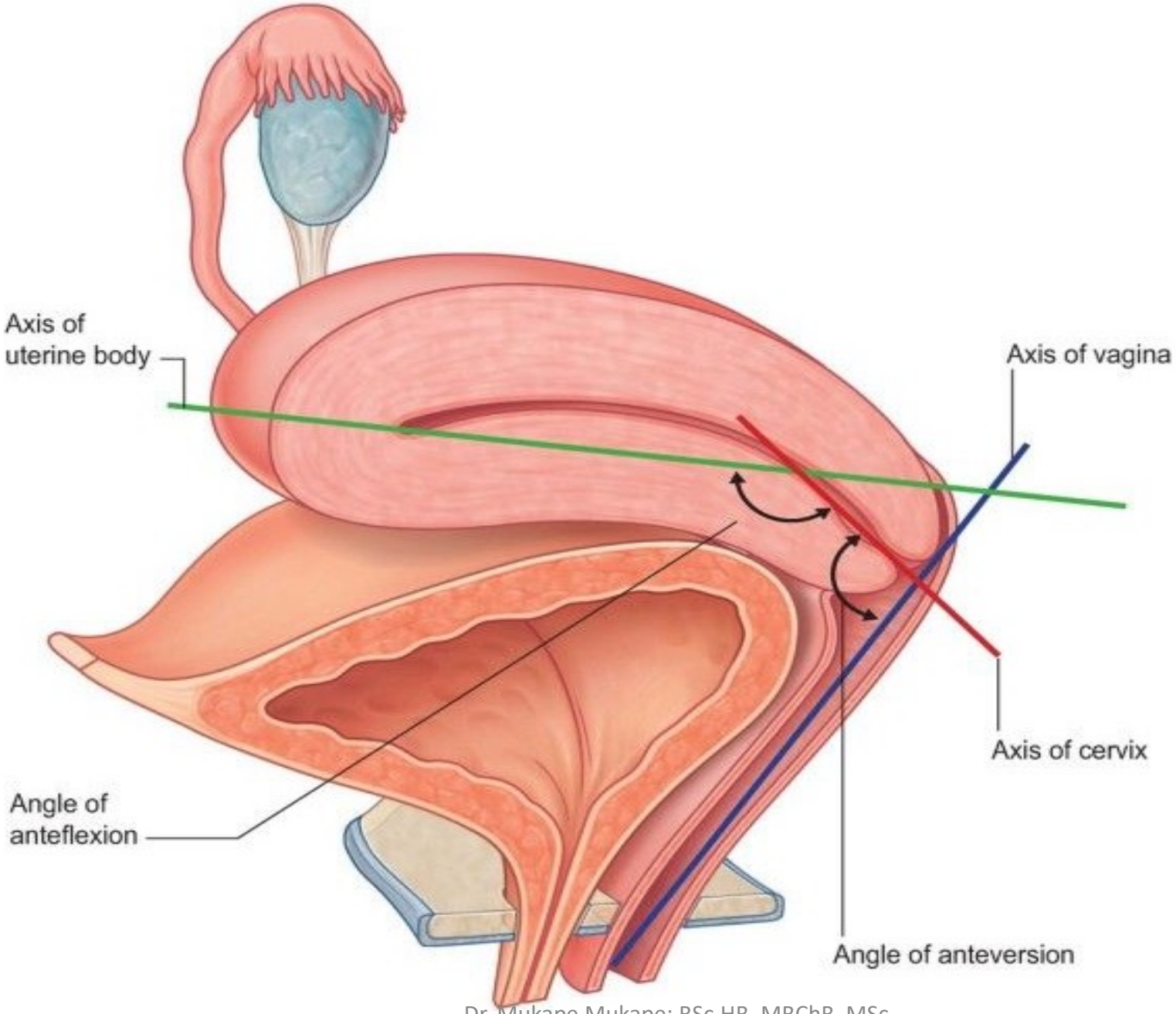
Superior view with peritoneum intact



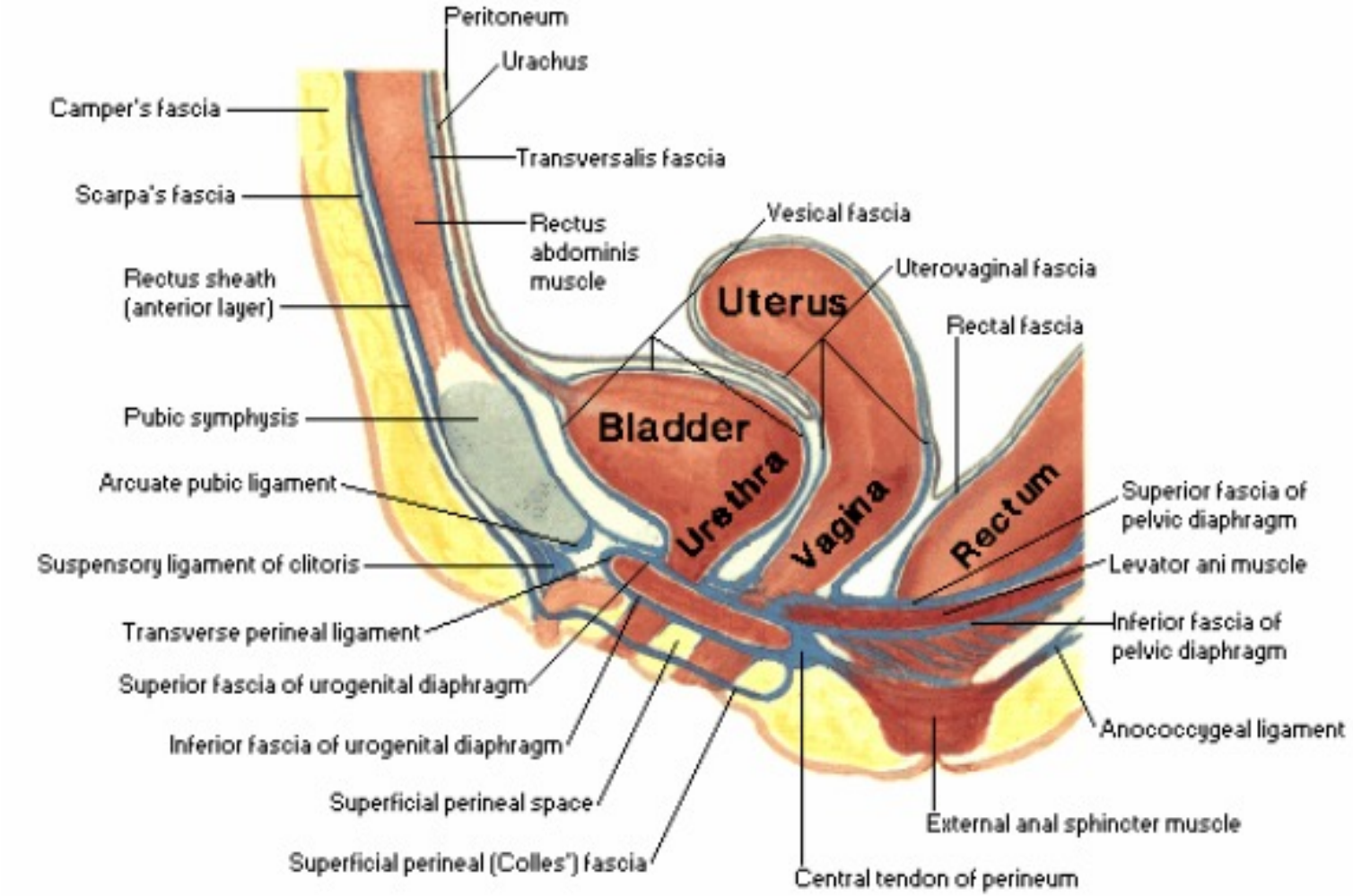
Superior view with peritoneum and uterus removed

Normal position and Angulation

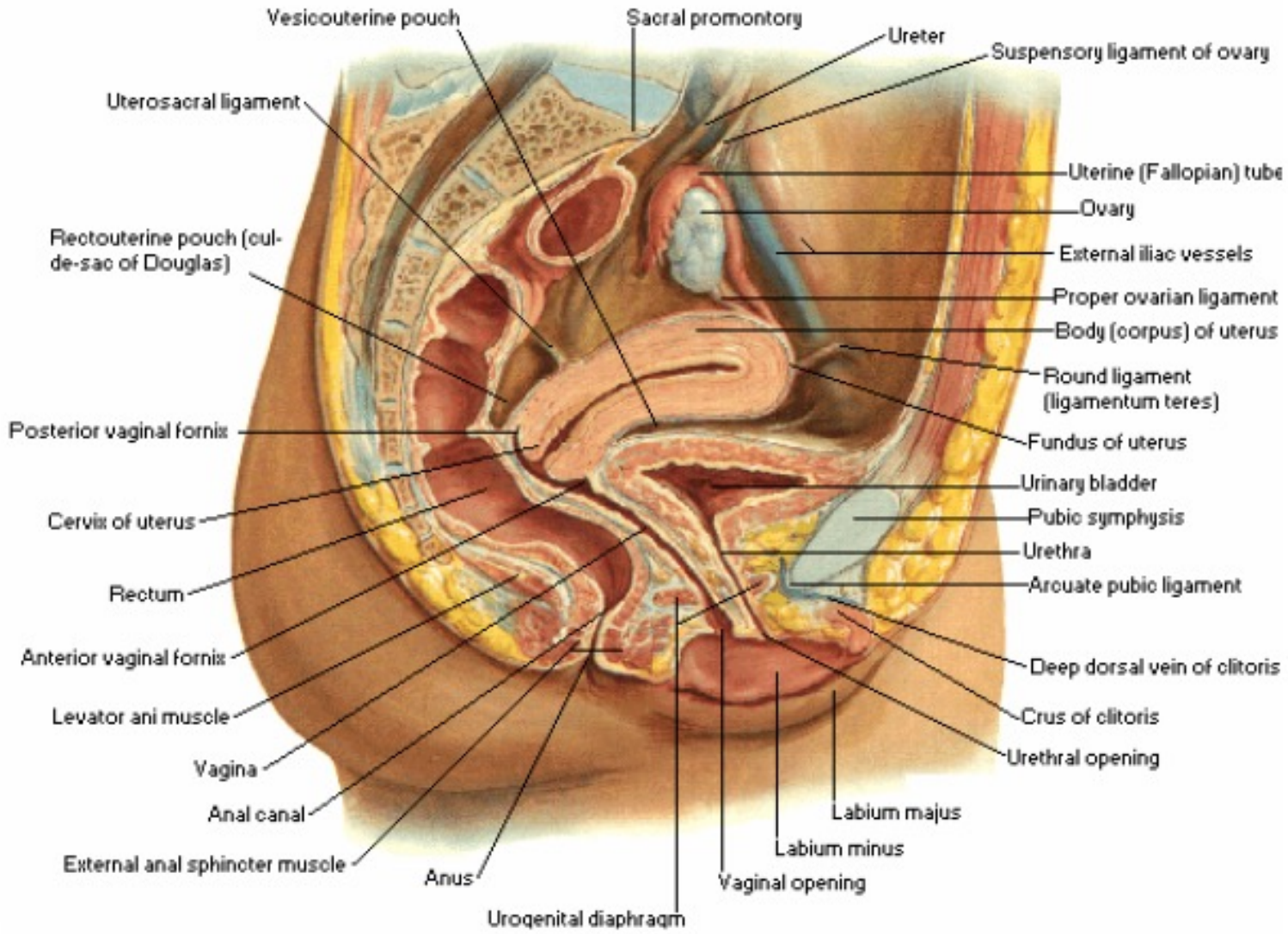
- Normally, long axis of the uterus forms an angle of about 90^{o} with the long axis of the vagina
- The angle is open forwards
- The forward bending of the uterus relative to the vagina is called **ANTEVERSION**
- The uterus is also flexed on itself referred to as **ANTEFLEXION**
- The angle of anteflexion is 125^{o}
- This position/angulation of the uterus prevents easy uterine prolapse


Axis of
uterine body
Axis of vagina
Axis of cervix
Angle of
anteflexion
Angle of anteversion

Midsagittal Section



Midsagittal Section



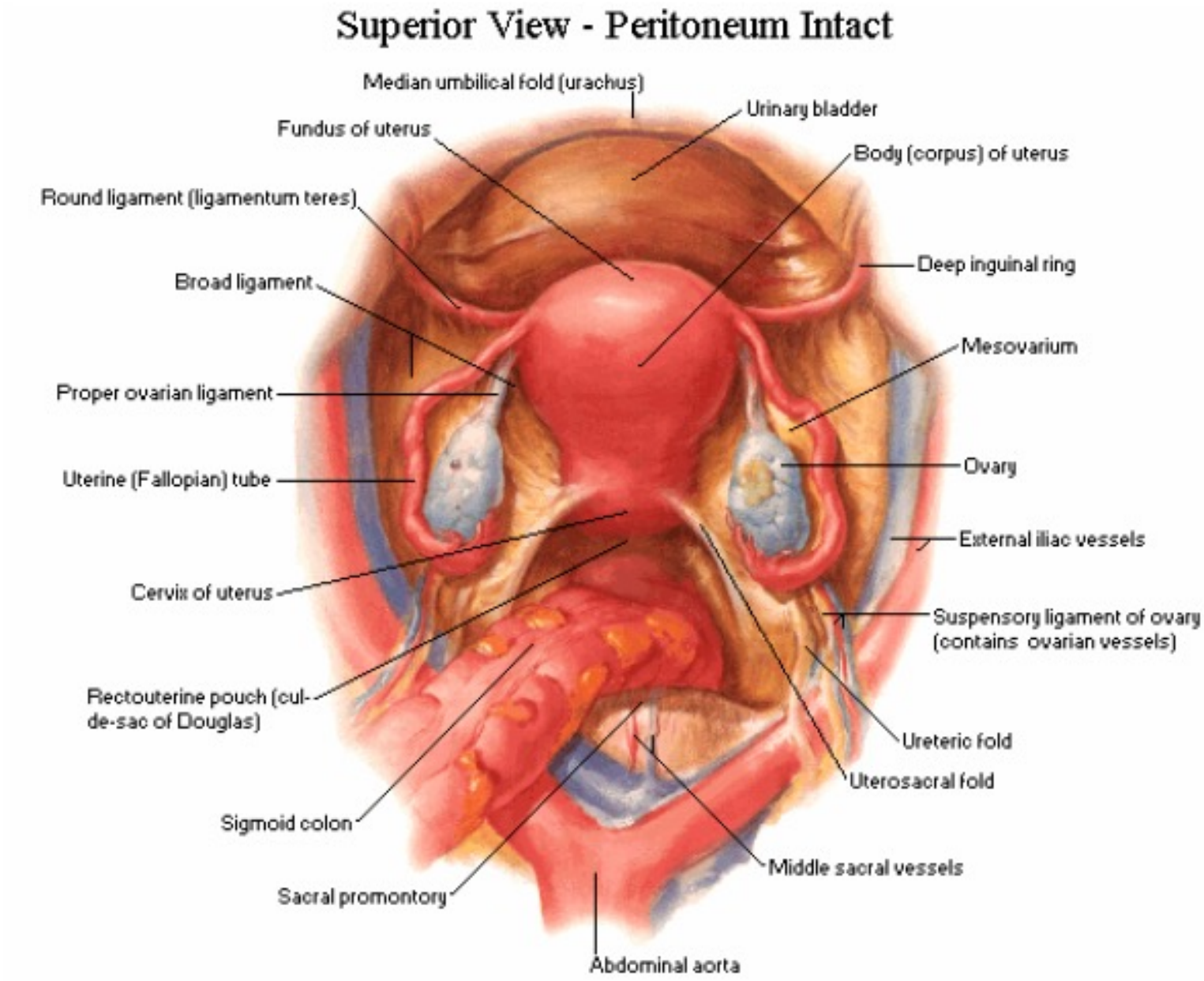
Rectovesical and Rectouterine Pouches

- Broad ligament attaches to the sides of the uterus and divides the pelvic cavity into two pouches
- Vesicouterine pouch: between bladder anteriorly and uterus posteriorly
- Rectouterine pouch of Douglas: between uterus anteriorly and rectum posteriorly
- Applied clinical anatomy:

❖ Care must be taken not to injure the urinary bladder when opening the abdomen during laparotomy e.g. in Caesarian sections

❖ Always catheterize patients for operations to empty the bladder and prevent injury

❖ Rectouterine pouch is a dependent pouch and fluid collects in it e.g. in ruptured ectopic pregnancy. The pouch can be accessed via the posterior vaginal fornix during culdocentesis to aspirate fluid from the space


Superior View - Peritoneum Intact
Median umbilical fold (urachus)
Urinary bladder
Fundus of uterus
Body (corpus) of uterus
Round ligament (ligamentum teres)
Deep inguinal ring
Broad ligament
Mesovarium
Proper ovarian ligament
Ovary
Uterine (Fallopian) tube
External iliac vessels
Cervix of uterus
Suspensory ligament of ovary (contains ovarian vessels)
Rectouterine pouch (cul-de-sac of Douglas)
Ureteric fold
Uterosacral fold
Sigmoid colon
Middle sacral vessels
Sacral promontory
Abdominal aorta

Supports of the Uterus

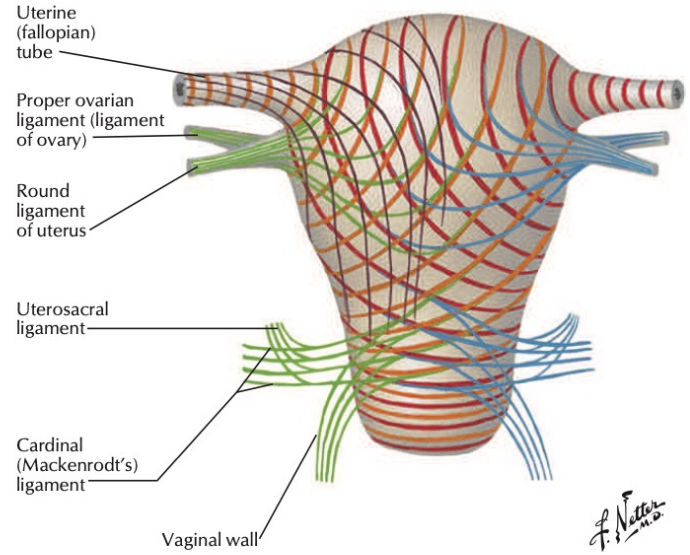
- Uterus is a mobile organ which undergoes extensive changes in size and shape during the reproductive period of life

- Supported and prevented from sagging down **(uterine prolapse)** by a number of factors which are chiefly muscular and fibromuscular ligaments

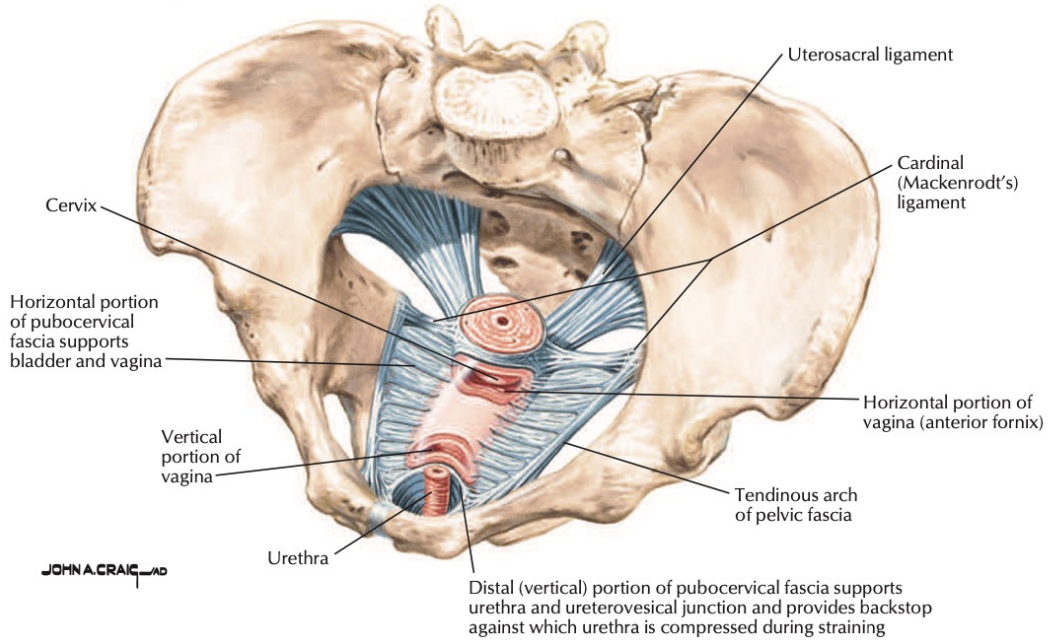
Supports of the Uterus

- Pelvic diaphragm
- Perineal body
- Uterine axis
- Pubocervical ligaments
- **Transverse cervical ligaments of Mackenrodt (cardinal ligaments)**
- **Uterosacral ligaments**
- Round ligament of the uterus

Fascial ligaments of uterus

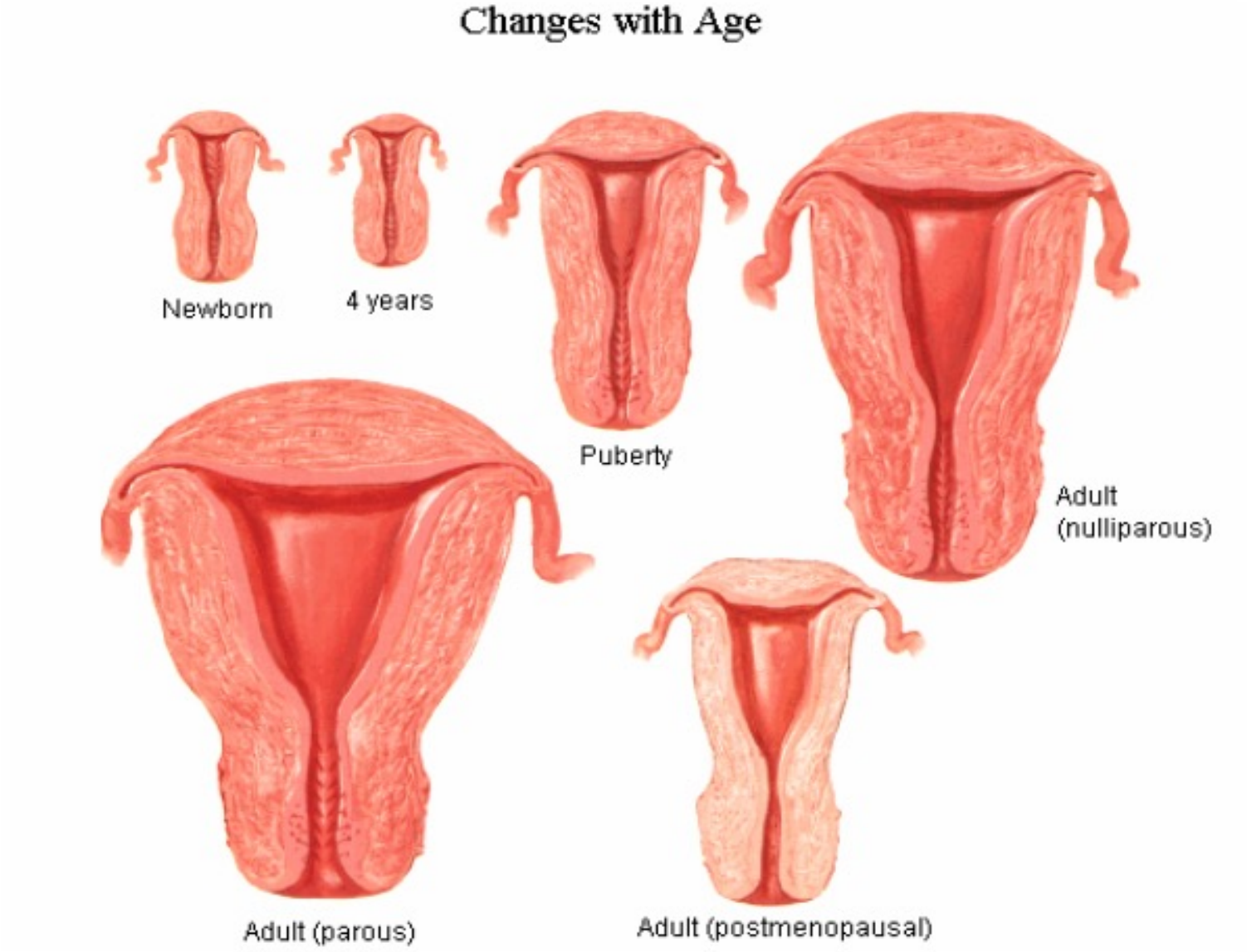


Pelvic fascia and ligaments



Structures found in Broad Ligament of the Uterus

- Uterine tube
- Round ligament of the uterus
- Ligament of the ovary
- Uterine vessels near its attachment to the uterus
- Ovarian vessels in the infundibulopelvic ligament
- Uterovaginal and ovarian nerve plexes
- Epoophoron
- Paroophoron
- Some lymph nodes and lymph vessels
- Dense connective tissue/parametrium


Changes with Age
Newborn
4 years
Puberty
Adult
(nulliparous)
Adult (parous)
Adult (postmenopausal)

Blood Supply to the Uterus

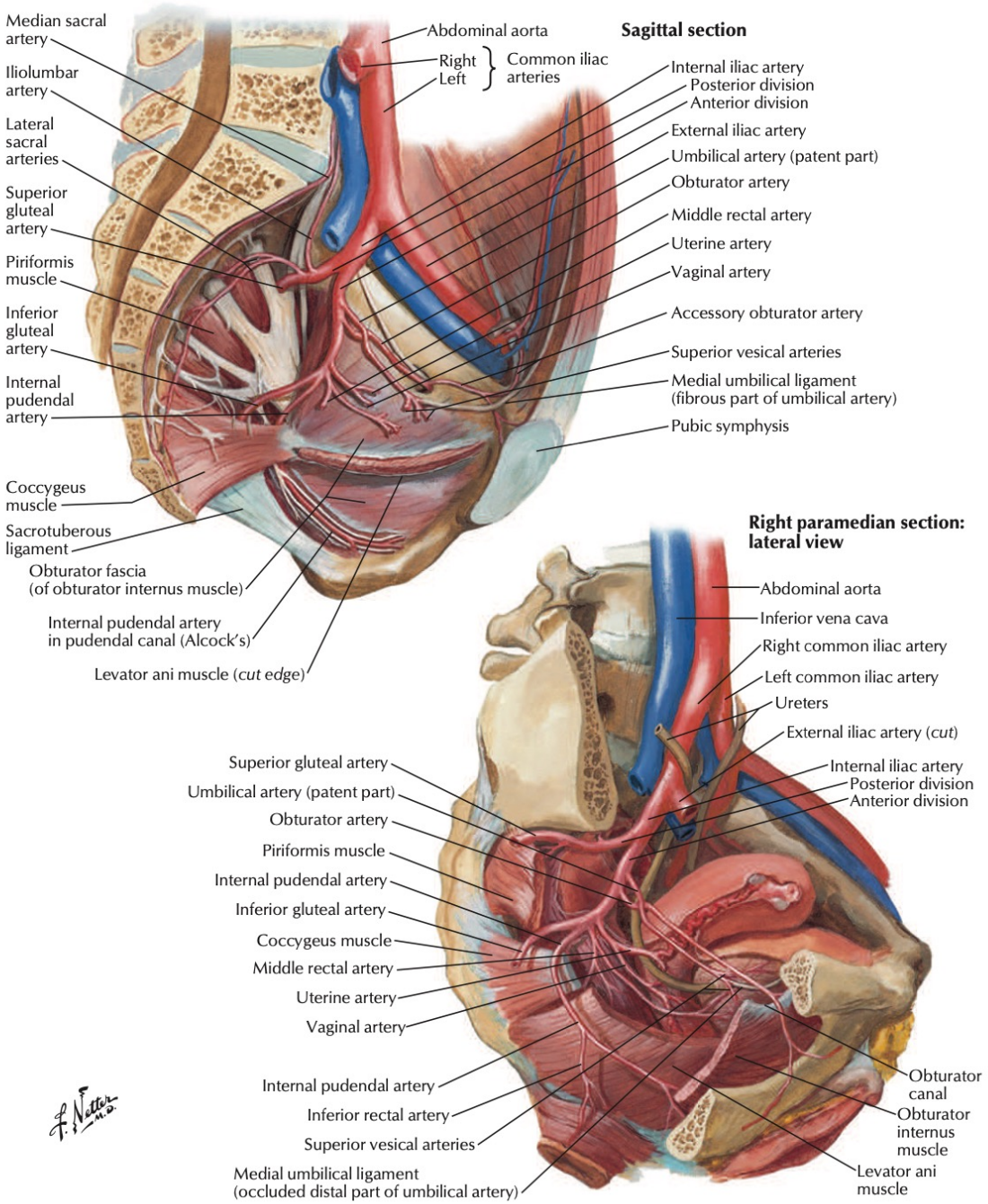
- Uterus is supplied by:

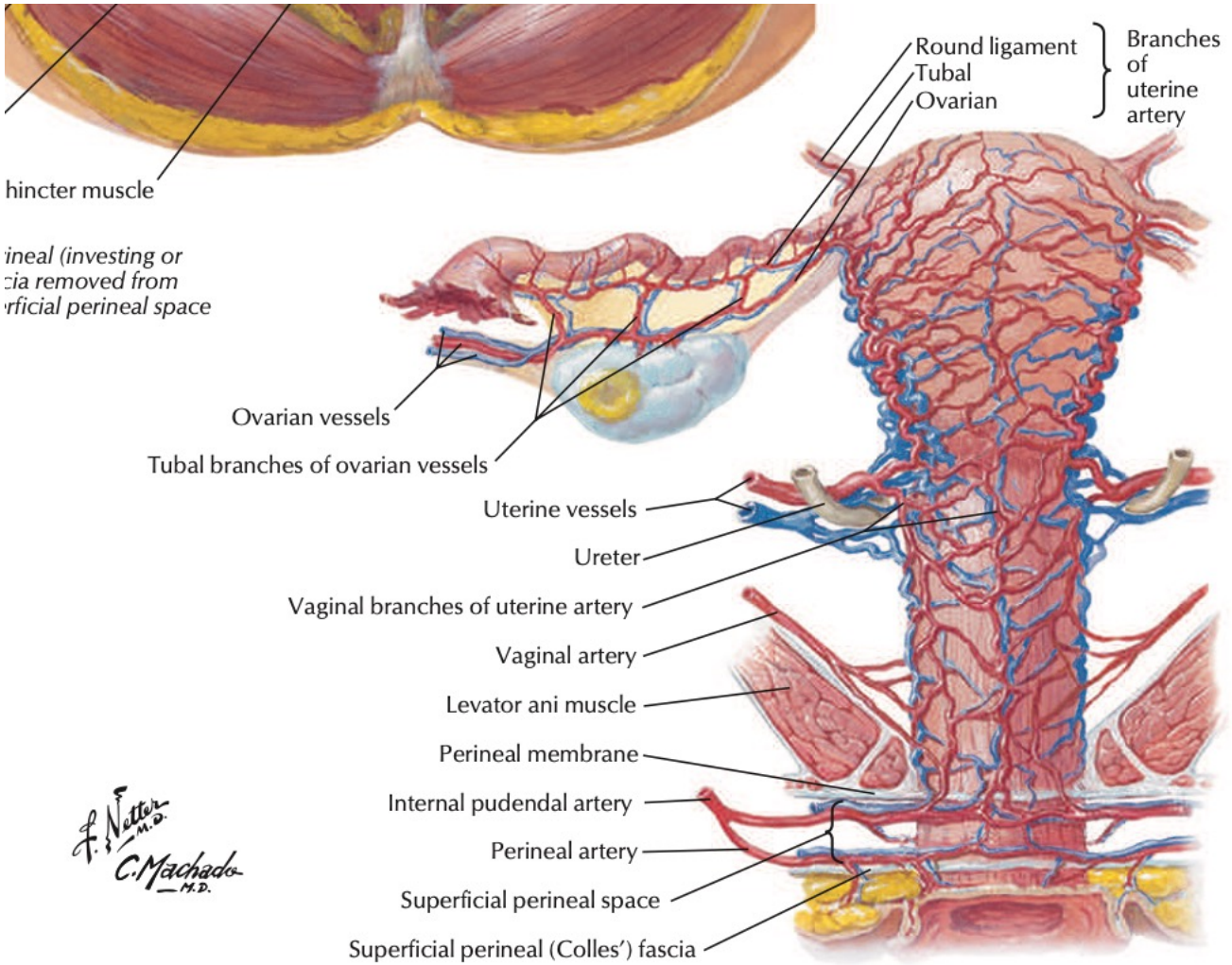
1. Uterine arteries (90%) from the anterior division of the internal iliac artery
2. Ovarian arteries (10%) from abdominal aorta

- **Uterine arteries first run medially towards the cervix, crossing the ureter above the lateral fornix of the vagina and 2 cm lateral to the cervix**
- **During hysterectomy, one has to be careful not to ligate the ureters as one ligates the uterine arteries**
- **To prevent ligation of ureters, push the urinary bladder down as much as possible and the ureters will go down with the bladder.**

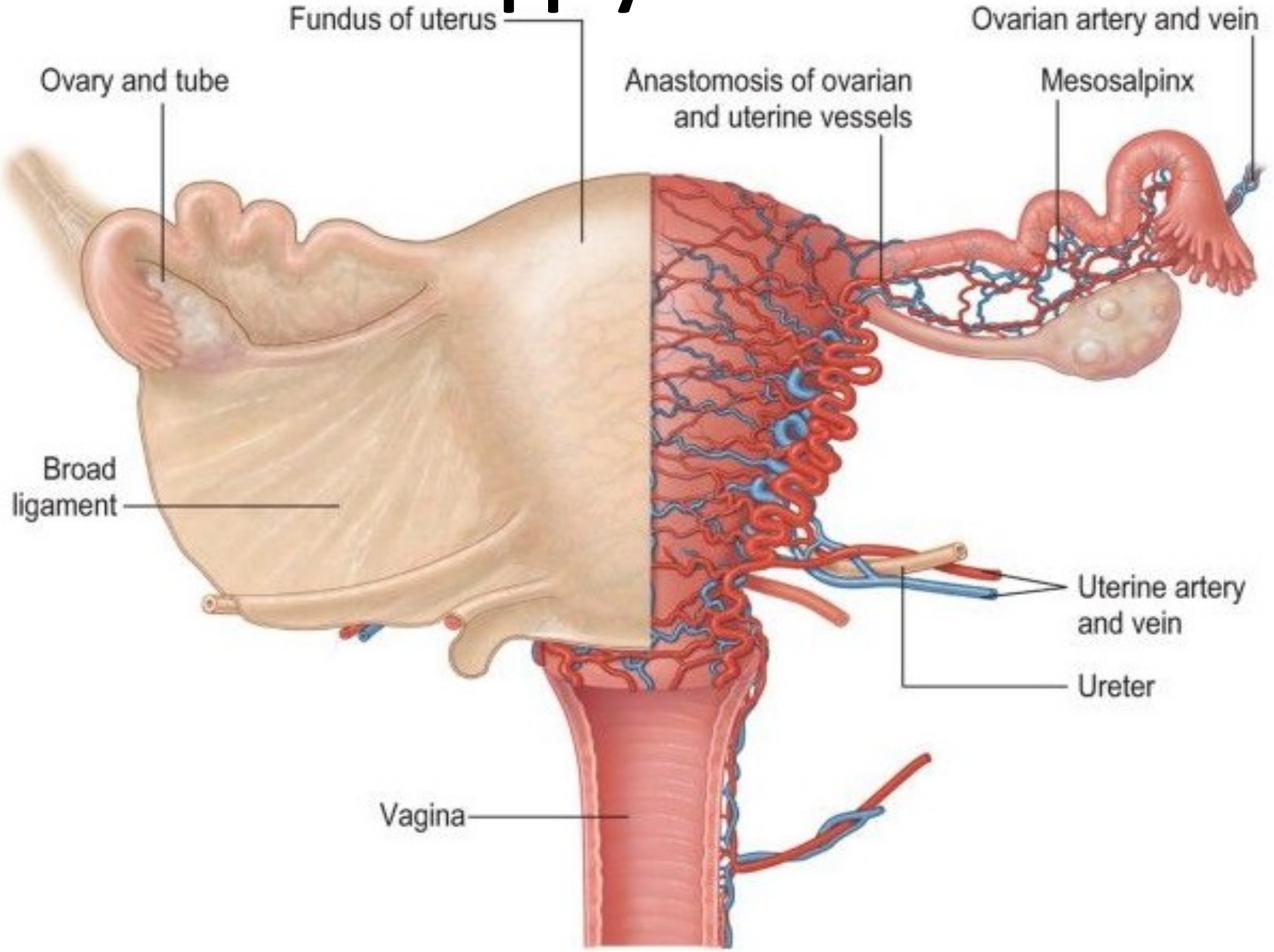
Blood Supply to the Uterus

- The artery ascends along the side of the uterus with a tortuous course. Finally it runs laterally towards the hilus of the ovary and ends by anastomosing with the ovarian artery.
- The anastomosis of the uterine artery and the ovarian artery at the cornual of the uterus gives off the **Sampson artery** to supply the round ligament of the uterus
- Uterine artery also supplies the vagina, medial two-thirds of the uterine tube, ovary, ureter and structures in broad ligament
- The tortuosity of the uterine artery without stretching the artery permits expansion of the uterus during pregnancy


Sagittal section
Median sacral artery
Iliolumbar artery
Lateral sacral arteries
Superior gluteal artery
Piriformis muscle
Inferior gluteal artery
Internal pudendal artery
Coccygeus muscle
Sacrotuberous ligament
Obturator fascia (of obturator internus muscle)
Internal pudendal artery in pudendal canal (Alcock's)
Levator ani muscle (cut edge)
Abdominal aorta
Right
Left
Common iliac arteries
Internal iliac artery
Posterior division
Anterior division
External iliac artery
Umbilical artery (patent part)
Obturator artery
Middle rectal artery
Uterine artery
Vaginal artery
Accessory obturator artery
Superior vesical arteries
Medial umbilical ligament (fibrous part of umbilical artery)
Pubic symphysis
Right paramedian section: lateral view
Abdominal aorta
Inferior vena cava
Right common iliac artery
Left common iliac artery
Ureters
External iliac artery (cut)
Internal iliac artery
Posterior division
Anterior division
Superior gluteal artery
Umbilical artery (patent part)
Obturator artery
Piriformis muscle
Internal pudendal artery
Inferior gluteal artery
Coccygeus muscle
Middle rectal artery
Uterine artery
Vaginal artery
Internal pudendal artery
Inferior rectal artery
Superior vesical arteries
Medial umbilical ligament (occluded distal part of umbilical artery)
Obturator canal
Obturator internus muscle
Levator ani muscle


hincter muscle
ineal (investing or
cia removed from
rficial perineal space
Round ligament
Tubal
Ovarian
Branches of uterine artery
Ovarian vessels
Tubal branches of ovarian vessels
Uterine vessels
Ureter
Vaginal branches of uterine artery
Vaginal artery
Levator ani muscle
Perineal membrane
Internal pudendal artery
Perineal artery
Superficial perineal space
Superficial perineal (Colles') fascia
F. Netter M.D.
C. Machado M.D.

Blood supply to the Uterus



Relationship of the Ureter with the Uterine Artery
(water under the bridge)

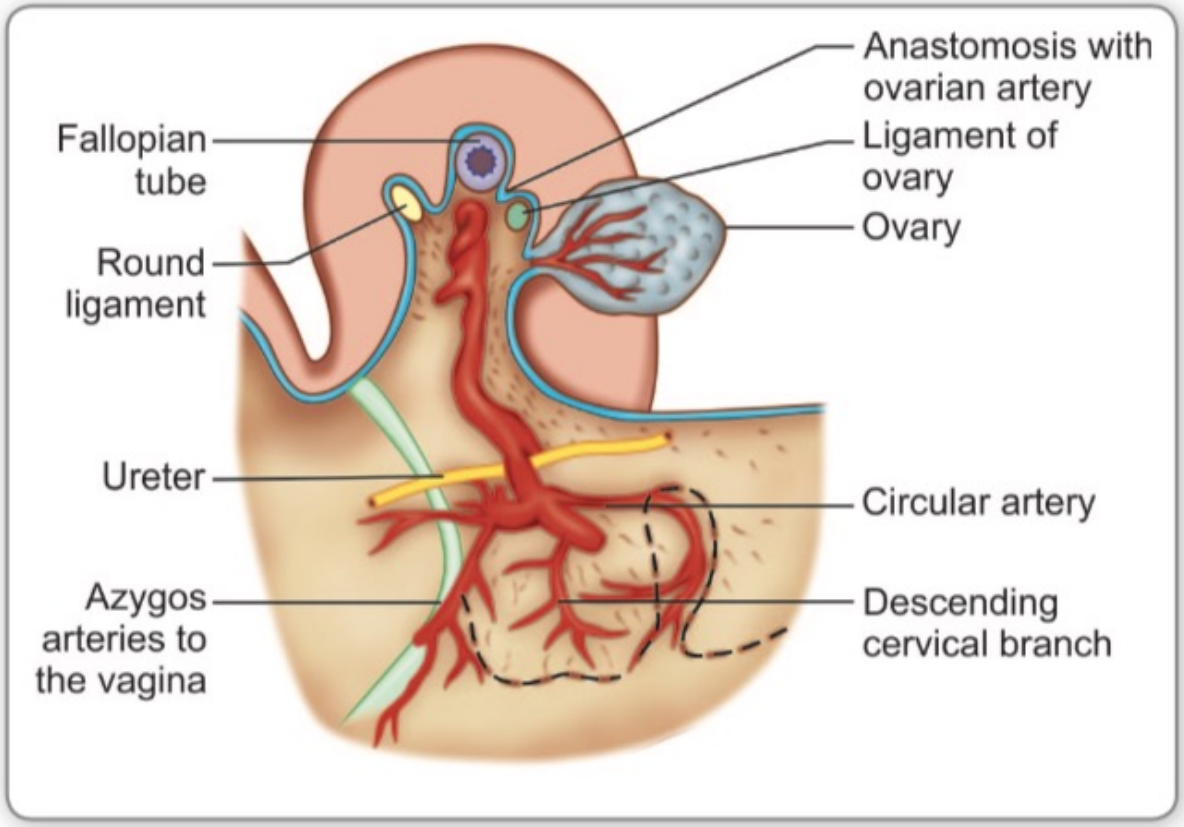
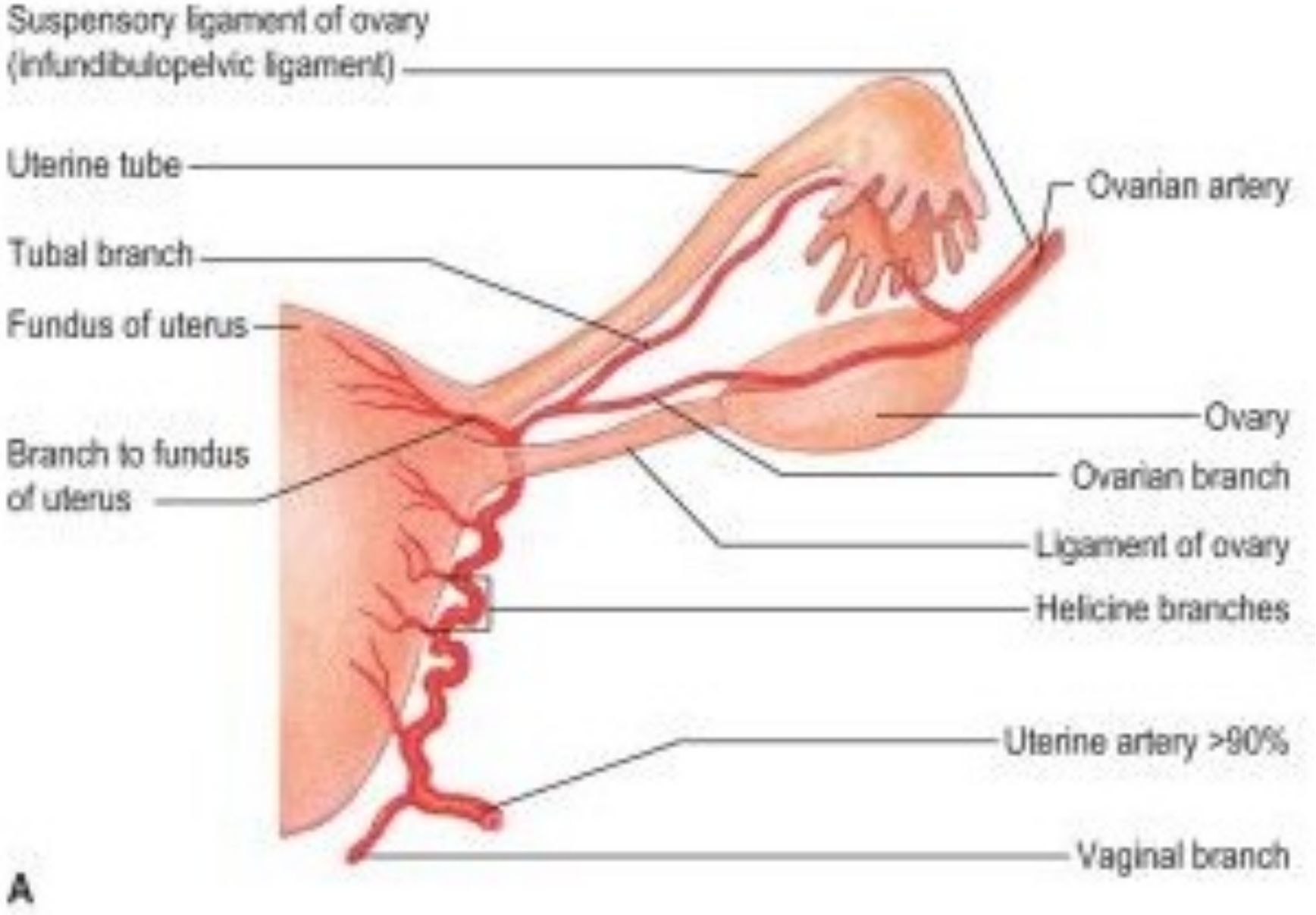


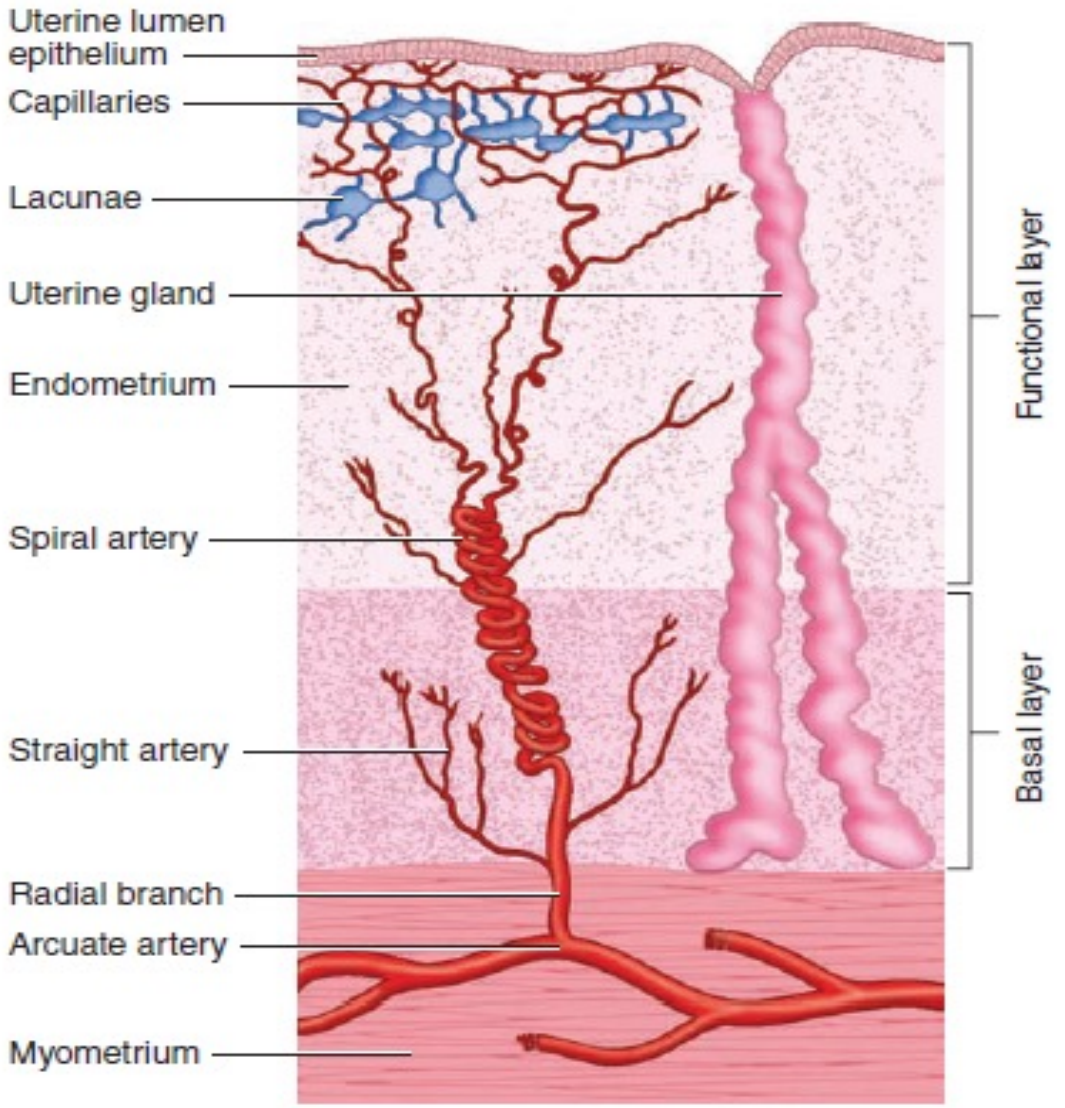
Fig. 1.5: The relation of the ureter to the uterine artery


Suspensory ligament of ovary
(infundibulopelvic ligament)
Uterine tube
Tubal branch
Fundus of uterus
Branch to fundus
of uterus
Ovarian artery
Ovary
Ovarian branch
Ligament of ovary
Helicine branches
Uterine artery >90%
Vaginal branch
A

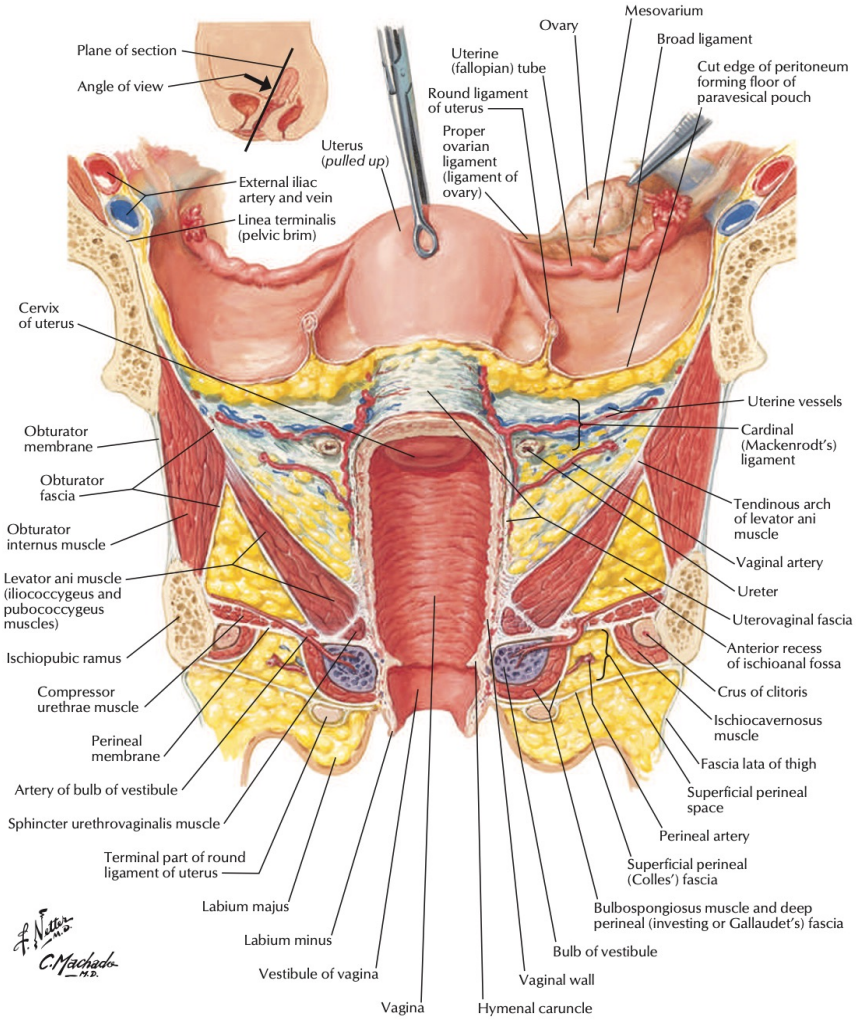
- The blood vessels supplying the endometrium are of special significance in the periodic sloughing of most of this layer
- **Arcuate arteries** are circumferentially oriented in the middle layers of the myometrium
- From these vessels, two sets of arteries arise to supply blood to the endometrium:

- **Straight arteries,** which supply the basalis
- **Spiral arteries,** which bring blood to the functionalis

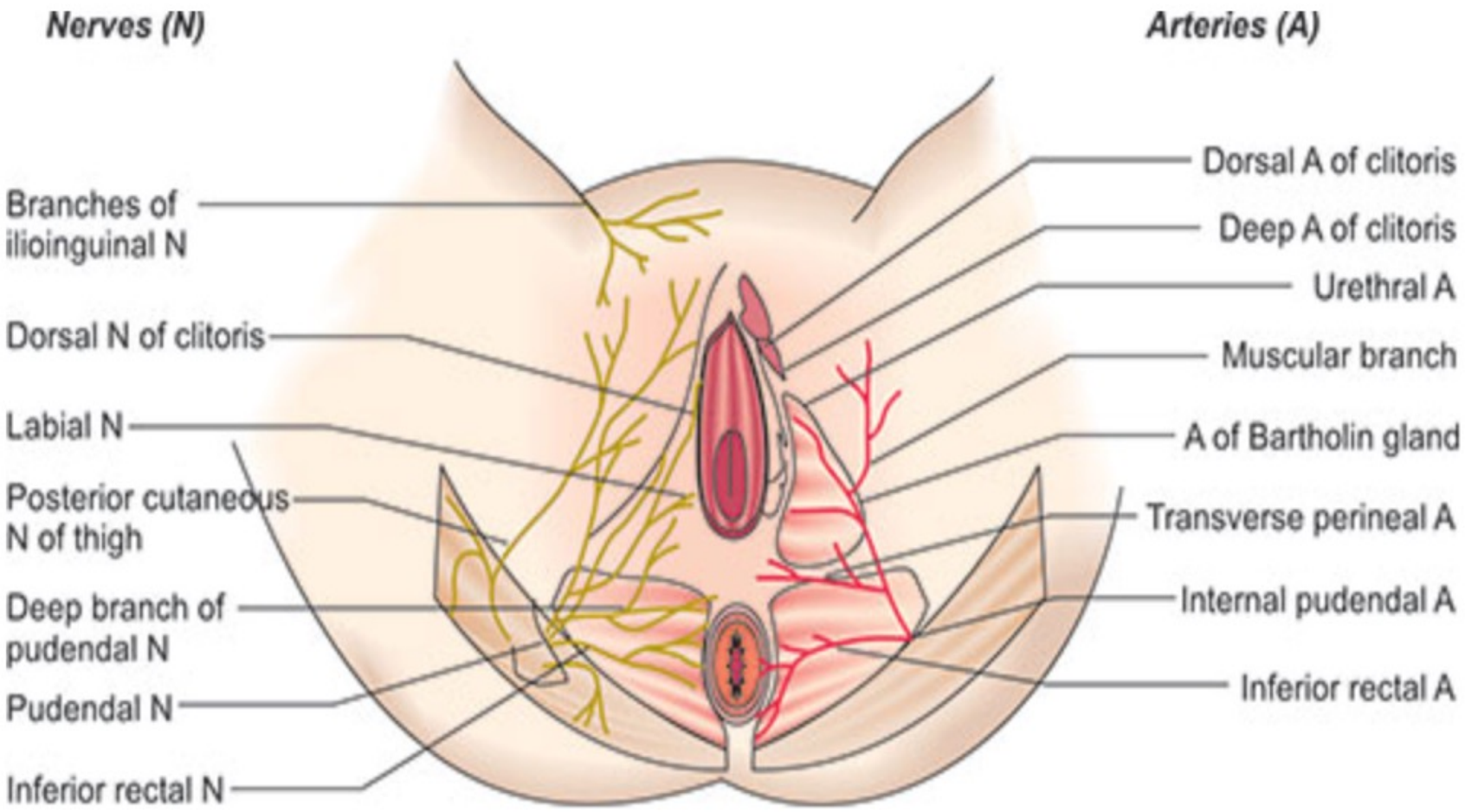
Arterial Supply to the Endometrium



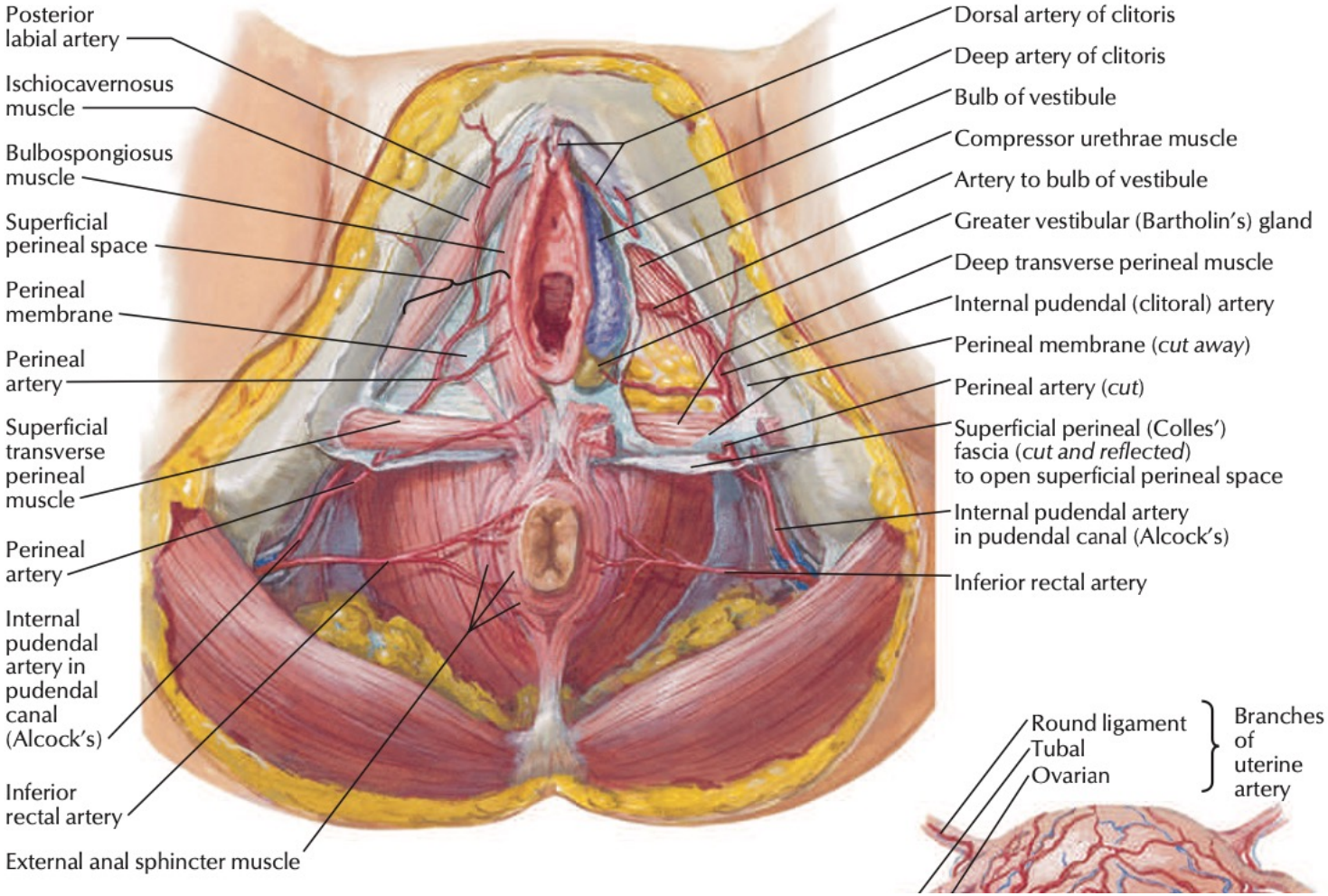
Vagina


Plane of section
Angle of view
Uterus (pulled up)
External iliac artery and vein
Linea terminalis (pelvic brim)
Ovary
Mesovarium
Broad ligament
Uterine (fallopian) tube
Round ligament of uterus
Proper ovarian ligament (ligament of ovary)
Cut edge of peritoneum forming floor of paravesical pouch
Cervix of uterus
Uterine vessels
Obturator membrane
Cardinal (Mackenrodt's) ligament
Obturator fascia
Tendinous arch of levator ani muscle
Obturator internus muscle
Vaginal artery
Levator ani muscle (iliococcygeus and pubococcygeus muscles)
Ureter
Uterovaginal fascia
Ischiopubic ramus
Anterior recess of ischioanal fossa
Compressor urethrae muscle
Crus of clitoris
Ischiocavernosus muscle
Perineal membrane
Fascia lata of thigh
Artery of bulb of vestibule
Superficial perineal space
Sphincter urethrovaginalis muscle
Perineal artery
Terminal part of round ligament of uterus
Superficial perineal (Colles') fascia
Labium majus
Bulbospongiosus muscle and deep perineal (investing or Gallaudet's) fascia
Labium minus
Bulb of vestibule
Vestibule of vagina
Vaginal wall
Vagina
Hymenal caruncle
F. Netter M.D.
C. Machado M.D.

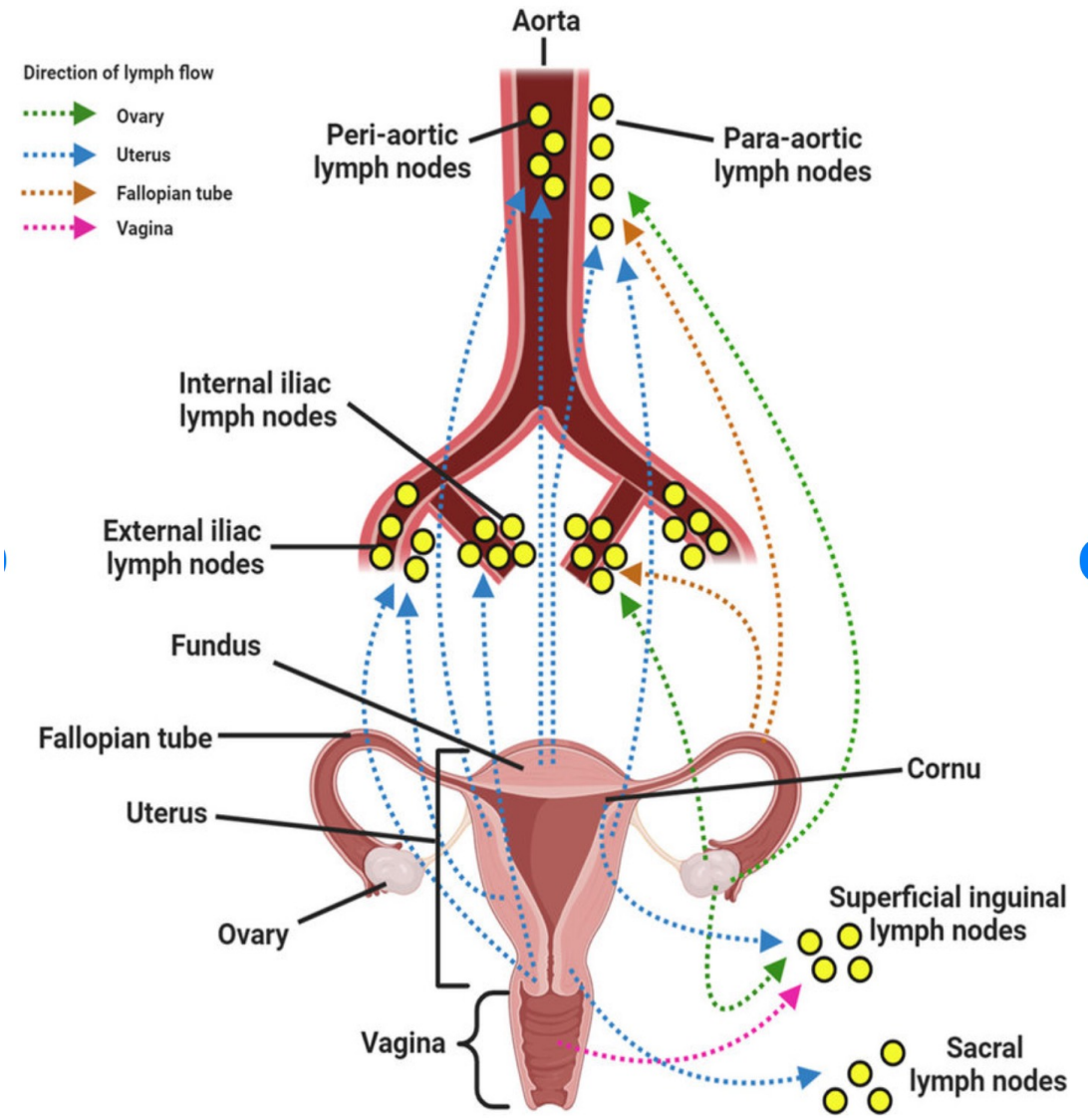
Blood Vessels and Nerve Supply of the Vulva



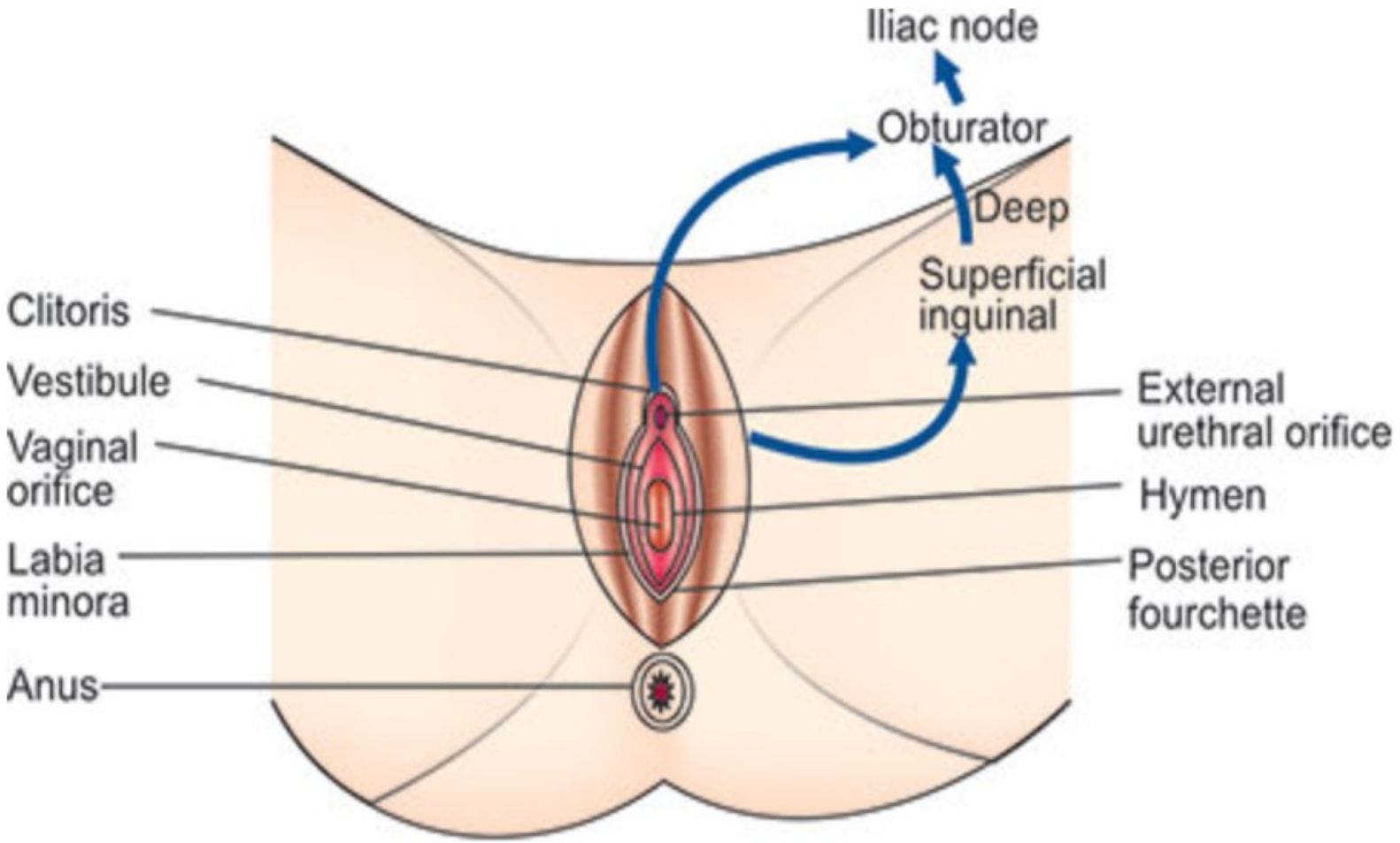
Blood Vessels and Nerve Supply of the Vulva



Lymphatic Drainage of the Female Internal Genitalia



Lymphatic Drainage of the Female External Genitalia



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