Urogenital System

ANATOMY

○ Sheet ○ Slide ● Handout

Number

3

Subject

Done By

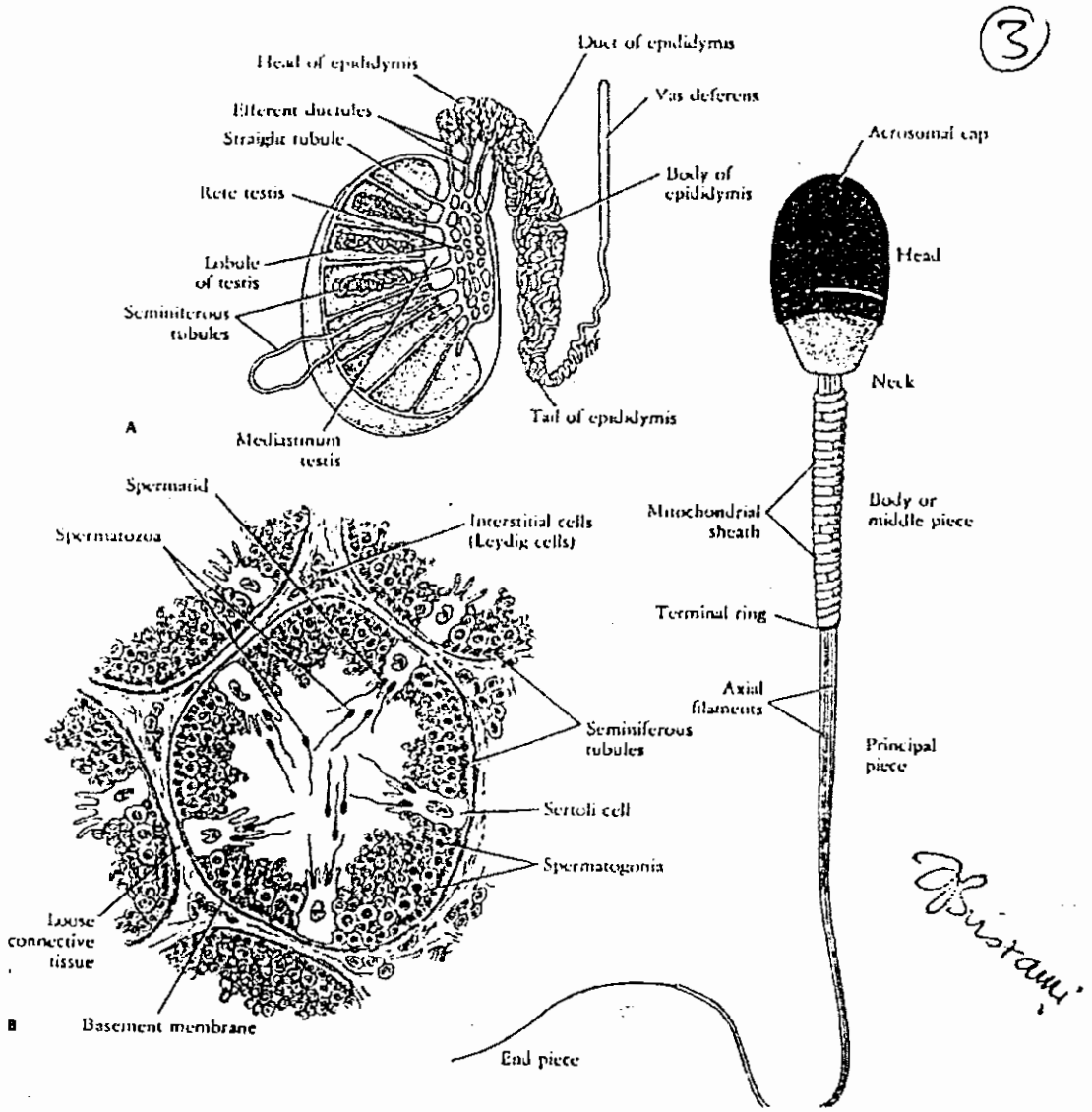
Corrected by

Doctor

Dr. Faraj Bustami

Date: **3/4/2017**

Price: **55**



The male reproductive system consists of a pair of testes, their excretory ducts, the accessory glands, and the penis (Fig. 14-1). The excretory ducts on each side are the epididymis, the vas deferens, and the ejaculatory duct. The accessory glands are a pair of seminal vesicles, a pair of bulbo-urethral glands, and the prostate gland.

TESTES

The testes are paired organs that produce the male germ cells, the *spermatozoa*, and the male sex hormones, the *androgens*. The testes are situated in the scrotum. In early fetal life, the testes are situated in the abdominal cavity, near the kidneys. As the fetus matures, the testes descend and, just before birth, pass through the inguinal canal to enter the scrotum. The descent of the testes from the abdominal cavity into the scrotum is important, because the development of spermatozoa (spermatogenesis) will take place normally only if the testes are at a temperature lower than that of the abdominal cavity.

Each testis has a thick fibrous capsule, the *tunica albuginea* (Fig. 14-2), which thickens posteriorly to form the *mediastinum testis*. Extending from the inner surface of the capsule to the mediastinum is a series of fibrous septa that divide the interior of the organ into about two hundred and fifty lobules. Lying within each lobule are one to three coiled *seminiferous tubules* (Figs. 14-3 and 14-4; see Fig. 14-2). Each tubule is in the form of a loop, each end of which is continuous with a *straight tubule*. The straight tubules open into a network of channels within the mediastinum testis called the *rete testis* (see Figs. 14-2 and 14-5). Within each lobule, between the seminiferous tubules, are delicate connective tissue and groups of rounded or polyhedral *interstitial cells* that produce the male sex hormones.

The rete testis is drained by *efferent ductules* into a long, much-coiled duct, the *epididymis* (see Fig. 14-2), that is situated on the posterior surface of the testis.

Seminiferous Tubule

The wall of the seminiferous tubule (Figs. 14-6–14-8) has a basement membrane lined with two types of cells: (1) numerous germinal cells, the *spermatogonia*, and (2) supporting cells, the Sertoli cells.

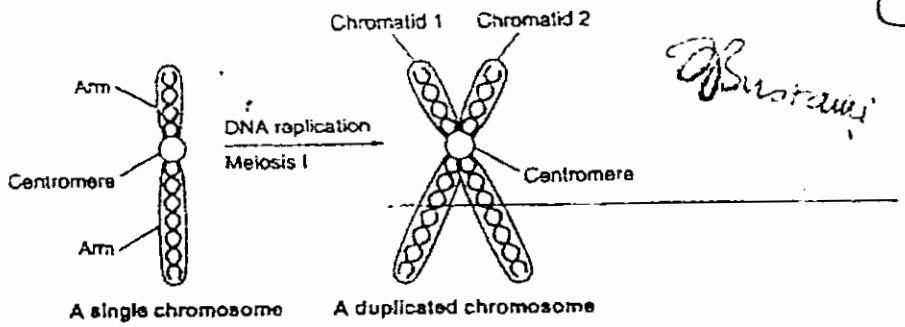


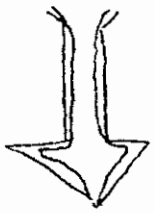
Figure 1-1. A schematic diagram showing a "single chromosome" and a "duplicated chromosome" that is formed by DNA replication during meiosis I.

2. Normal somatic cells and primordial germ cells

- –contain **46 single chromosomes** and **2N amount of DNA**; the chromosomes occur in **23 homologous pairs**; one member (**homologue**) of each pair is of **maternal origin** and the other is of **paternal origin**.
- –The term "diploid" is classically used to refer to a cell containing 46 single chromosomes.
  - a. Pairs 1 to 22 are **autosomal (non-sex) pairs.**
  - b. Pair 23 consists of the **sex chromosomes** (XX for a female or XY for a male).

3. Gametes

- –contain **23 single chromosomes** (22 **autosomes and 1 sex chromosome**) and **1N amount of DNA**.
- –The term "haploid" is classically used to refer to a cell containing 23 single chromosomes.
  - a. Female gametes contain **only the X sex chromosome.**
  - b. Male gametes contain **either the X or Y sex chromosome**; therefore, the **male gamete determines the genetic sex** of the individual.



–Meiosis is a specialized process of **cell division** that occurs **only in the production of gametes.** It consists of **two divisions** that result in the formation of four gametes, each containing **half the number of chromosomes (23 single chromosomes)** and **half the amount of DNA (1N)** found in normal somatic cells (46 single chromosomes, 2N).

14) Descent, engaged (progression)

15) All of the following regarding labor true except associated with lower abdominal pain

16) Vulvovaginitis MCC of: prepubertal bleeding

17) All are in favor of synchronus two primaries except: Positive cytology

18) All causes oligo except pulm. hypoplasia

---

19) Not in criteria of PCOS: hyperprolactinemia

20) pap smear showed few inflammatory cells: continue regular PAP smears D/C

21) Wrong about Molar: ass. With inc. risk of anomalies

---

22) Wrong about BPP: fetal heart rate 120-160

23) Canalization imperforated hymen

24) Most indicative for uterine rupture fetal distress

25) Endometroid the answer was c I even can't remember what was the choice

رفعللمعنوياتمنالدكتوركميل .. لايهمككمجبتالمهمانكلمتياز بالجامعةلانومابدناغير الاردنية

بالتوفيقللماكسلك grin emoticon

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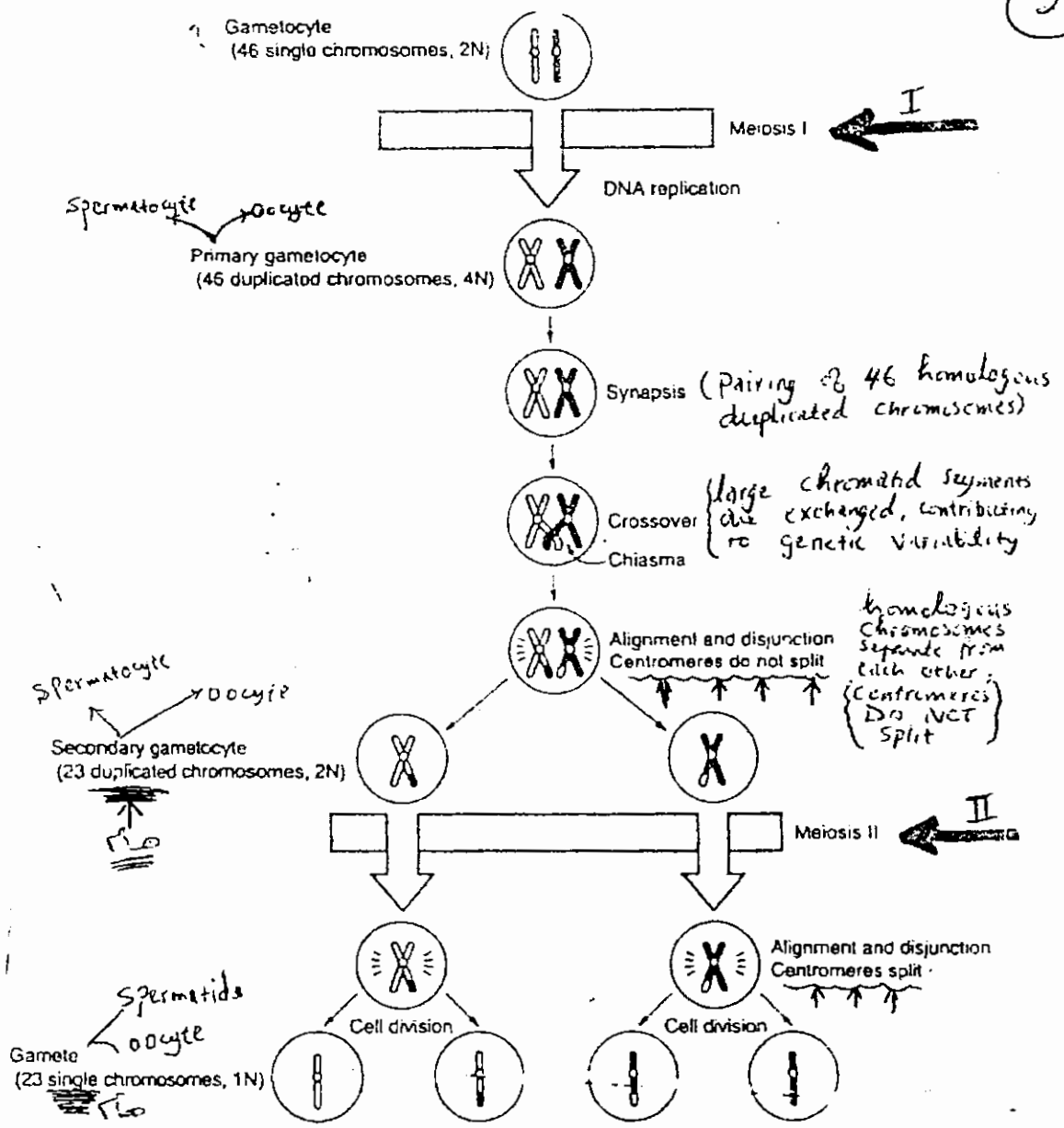
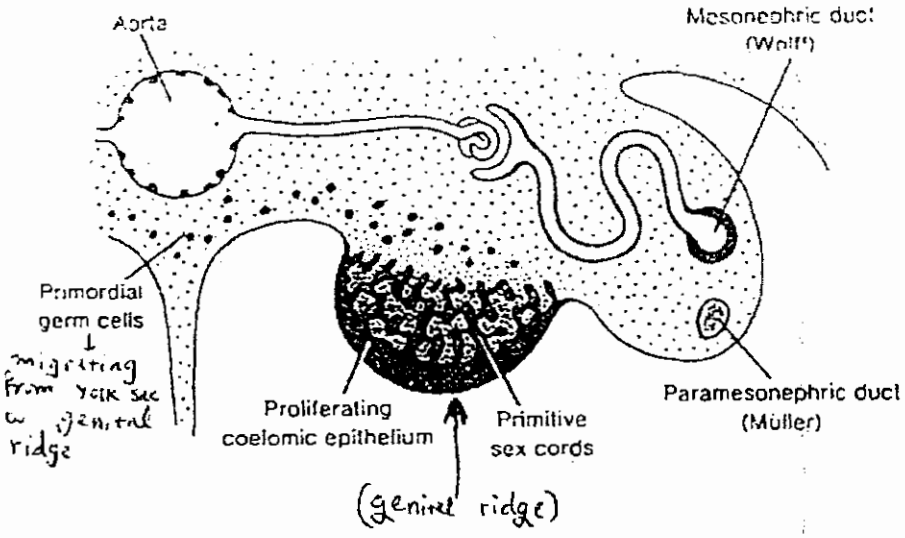


Hence, the <u>purpose of the two meiotic divisions</u> is <u>twofold</u>:

(1) to enable the members of the homologous chromosome pair to exchange blocks of genetic material (first meiotic division)

(2) to provide each germ cell with both a <u>haploid number of chromosomes</u> and <u>half the amount of DNA</u> of a normal somatic cell (second meiotic division)



Consideration of Male Events

A. Spermatogenesis: Formation of the male gamete

1. **Primordial germ cells** arrive in the gonad of a genetic male (testes) at week 4 and remain **dormant until puberty** (they came from yolk sac)
2. At puberty, primordial germ cells differentiate into **spermatogonia**, which undergo **mitosis** to provide a continuous supply of stem cells throughout the reproductive life of the male.
   a. Spermatogonia begin to give rise to **primary spermatocytes**, which enter **meiosis I** by undergoing DNA replication.
   b. Primary spermatocytes complete meiosis I to form **two secondary spermatocytes**.
   c. The two secondary spermatocytes complete **meiosis II** to form **four spermatids**.

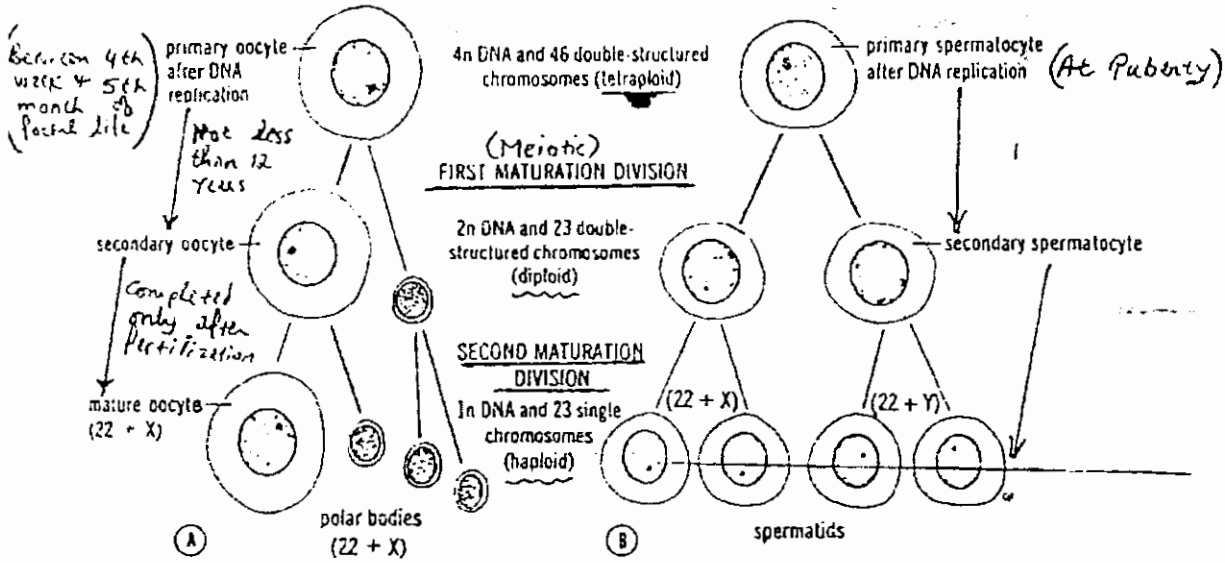


Figure 1-2. *Schematic drawing showing the events occurring during the first and second maturation divisions. A, The primitive female germ cell (primary oocyte) produces only one mature cell, the mature oocyte. B, The primitive male germ cell (primary spermatocyte) produces four spermatids, all of which develop into spermatozoa.*

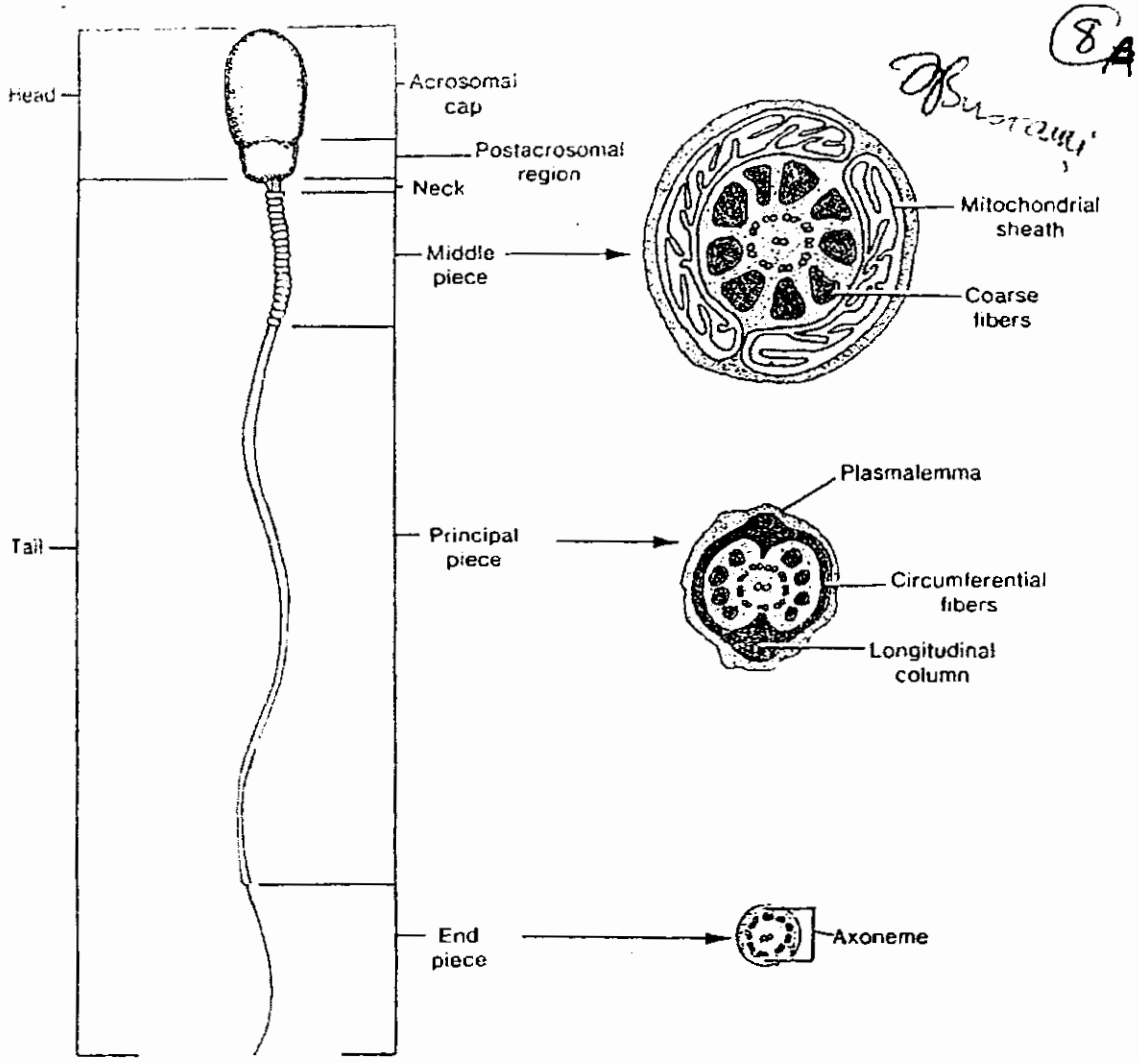
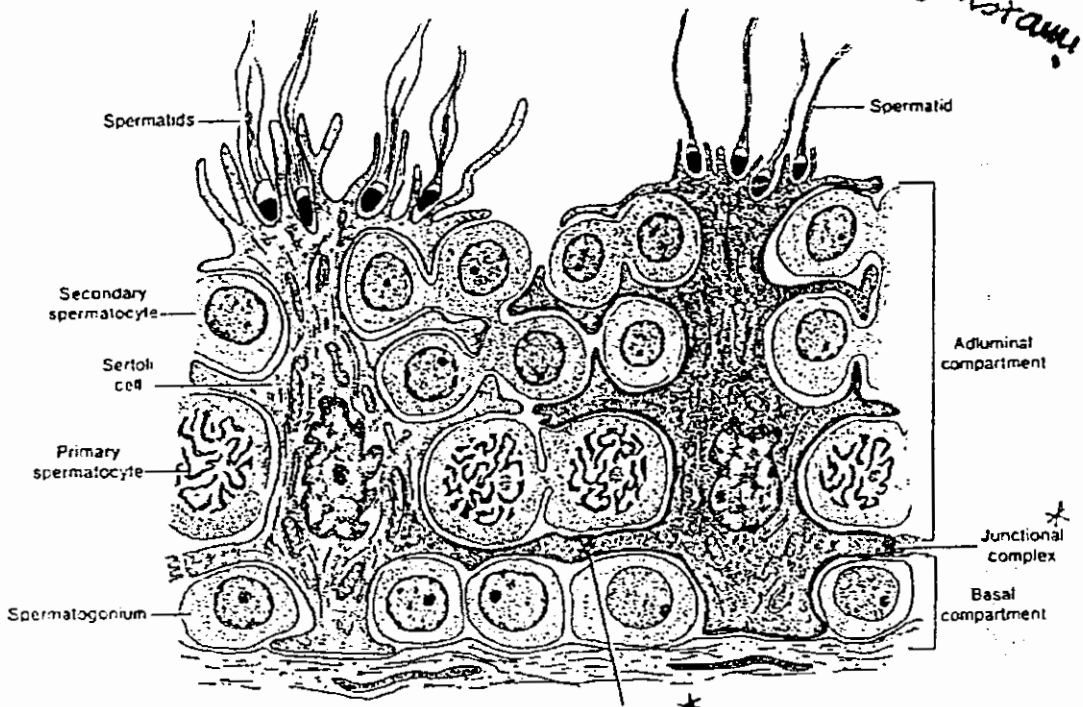


Figure 17–4 Structure of a spermatozoan.

Spermatozoa that lie free within the lumina of the seminiferous tubules consist of a **head**, which contains the nucleus, and a **tail** which eventually will give motility to the free cell. The chromatin of the nucleus is very condensed and reduced in volume, providing the functionally mature sperm with greater mobility. The condensed form of chromatin also protects the genome while the spermatozoon is enroute to fertilize the female germ cell. The **acrosomal cap** covers the anterior two-thirds of the nucleus and contains lysozomes that are important for penetration of the ovum during fertilization. The size and shape of the nucleus varies tremendously in different species.

The sperm tail measures about 55 μm in length and consists of four regions: the neck, middle piece, principal piece and end piece. The structural details of the different segments are best observed with the electron microscope.

The neck is that region where the head unites with the tail of the sperm and contains the connecting piece which joins the nine outer dense fibers of the sperm tail to the implantation fossa of the nucleus. The region of the connecting piece that joins the implantation fossa is expanded slightly and is called the **capitulum**. The **middle piece** extends from the neck of the sperm to the annulus and consists of the axoneme, the nine coarse fibers and the helical sheath of mitochondria. The **principal piece** is the longest portion of the tail and consists of the axoneme and the nine coarse fibers (2 + 9 + 9) enclosed by a sheath of circumferential fibers. The circumferential fibers join two longitudinal thickenings of this sheath, located on opposite sides. The **end piece** represents the shortest segment of the tail and consists only of the axoneme surrounded by the cell membrane.



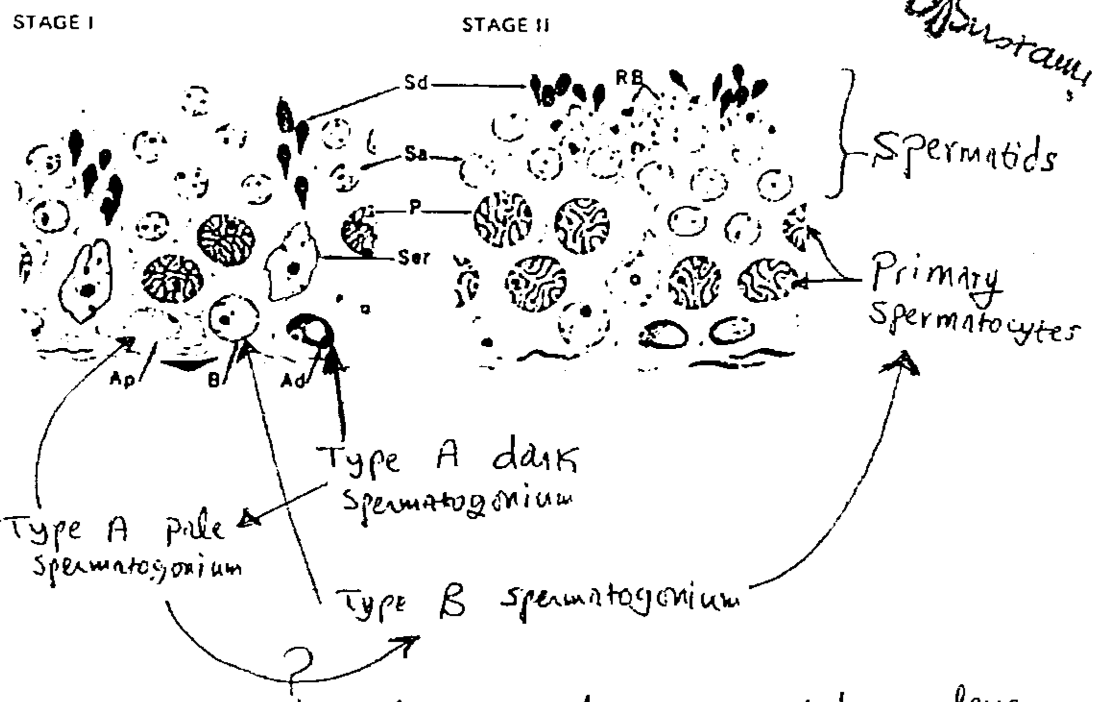
7-2 Germinal epithelium.

Spermatogenesis

The term *spermatogenesis* is applied to the sequence of events by which spermatogonia are transformed into spermatozoa (Fig. 14-9; see Fig. 14-8). The spermatogonia are stem cells situated along the basement membrane of the seminiferous tubule. They are large, rounded cells, and three types can be recognized, according to their nuclear appearance: type A dark (dark-staining nucleus), type A pale (pale-staining nucleus), and type B (spherical nucleus with clumps of chromatin along the nuclear membrane). Type A dark spermatogonia divide to maintain the numbers of spermatogonia and also to form some type A pale spermatogonia. Type A pale spermatogonia divide and differentiate into type B spermatogonia. After this division, type B spermatogonia divide by mitosis into *primary spermatocytes*. The latter cells migrate toward the middle zone of the seminiferous epithelium and then undergo meiotic division (the first meiotic division) into smaller *secondary spermatocytes*, each containing half the number of chromosomes of the primary cell (Fig. 14-10). The secondary spermatocytes soon divide (the second meiotic division) to form the smallest cells, the *spermatids*, which become embedded in the cytoplasm of the sides of the Sertoli cells. The spermatids now undergo a series of morphological changes leading to the formation of *spermatozoa*.

(Spermiogenesis)

Dr. Bustami
Histology of Repro.
(9) 1999
Bustami



Type A dark Spermatogonium
- large oval or rounded nucleus
- condensed chromatin
- nucleoli → attached to nuclear envelope
- nuclear vacuole } → may be prominent

↓ 46 Chromosomes (44 + X + Y)

Type B Spermatogonia
- a paler-stained nucleus
- centrally located nucleoli
- No nuclear vacuole

↓ mitotic division

Primary spermatocyte
- the LARGEST of the spermatogenic cells
- large nucleus with coarse clumps or thin threads of chromatin
- contains 23 pairs of chromosomes
- " 4n DNA (Just before meiosis) *

↓ 1st meiotic division

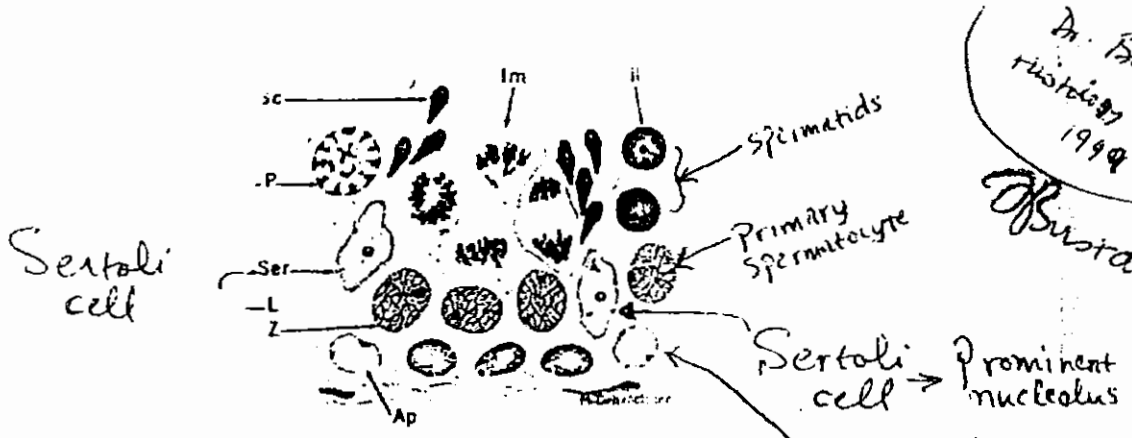
Secondary spermatocyte
- Smaller than primary sp.
- rapidly undergo second meiotic division (rarely seen)
- contains → 23 (double-structured) chromosomes → Diploid No.
- " → 2n DNA

↓ 2nd meiotic division

Spermatid → small cells (9 μ) → 1n DNA, 23 single chromosomes (haploid)

↓ spermiogenesis

Spermatozoa



H. Burstrom, Histologie et Physiol. 1969

H Burstrom

Sertoli cell → Columnar cell

extends from the basement membrane to the lumen of the tubule.

nucleus → ovoid or indented

* Prominent nucleolus

Cytoplasm at EM → SER, RER

Golgi apparatus

lysosomes * → Phagocytosis of residual bodies

lipid droplets

microfilaments & microtubules * → change in cell shape

Sertoli cells in seminiferous tubules are targets of FSH. The Sertoli cells primarily sustain spermatogenesis, as well as 1) form junctions between adjacent cells which are a barrier between interstitial fluid and tubule lumen, 2) produce androgen binding protein (ABP) and secrete it into the lumen for concentrating testosterone in the tubule, 3) aid sperm viability by maintaining high [K] and [HCO_3] in luminal fluid, and 4) synthesize estradiol and inhibin.

ß Both $<^{FSH}_{LH}$ are required for Spermatogenesis → LH effects are mediated by testosterone → So only $<^{testosterone}_{FSH}$ act directly on Seminiferous tubules

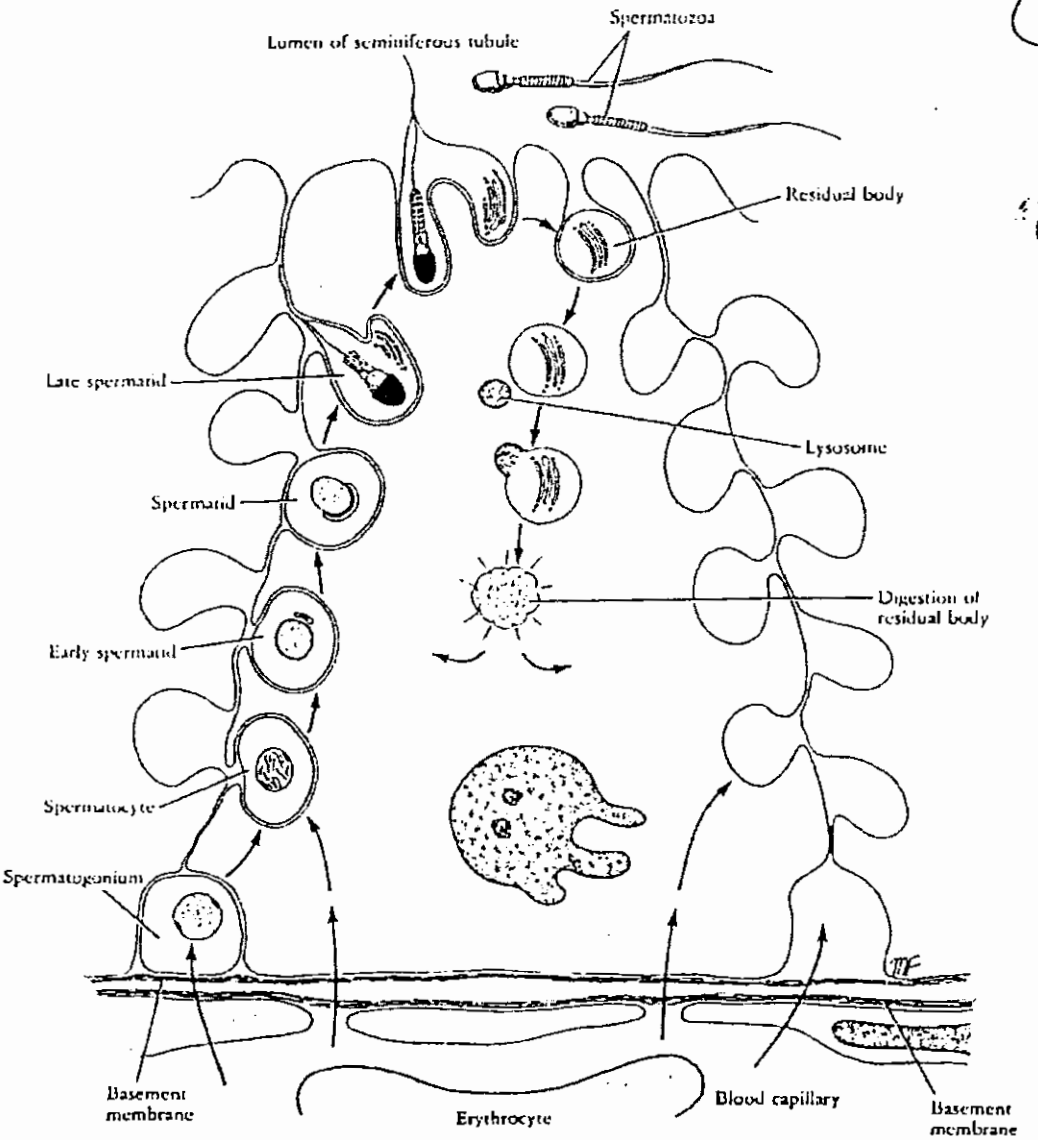


Fig. 14-9. Sertoli cell and the part it plays in spermatogenesis. Note the tight junctions situated near the base of the cell that separate the spermatogonia from the more superficial spermatocytes and spermatids. The arrows passing upward from the capillary indicate the pathways taken by nutrients and hormones.

Remember ① The Sertoli cells provide nutrients to the differentiating sperms (which are isolated from the blood stream) → arrows in the above diagram

② Sertoli cells form tight junctions with each other → creating a barrier between the testis and blood stream called the BLOOD – TESTIS BARRIER → imparts selective permeability allowing testosterone to cross but prohibiting noxious substances that might damage the developing sperms

③ Sertoli cells secrete an aqueous fluid into the lumen of the seminiferous tubules which help to transport the sperms into the epididymis

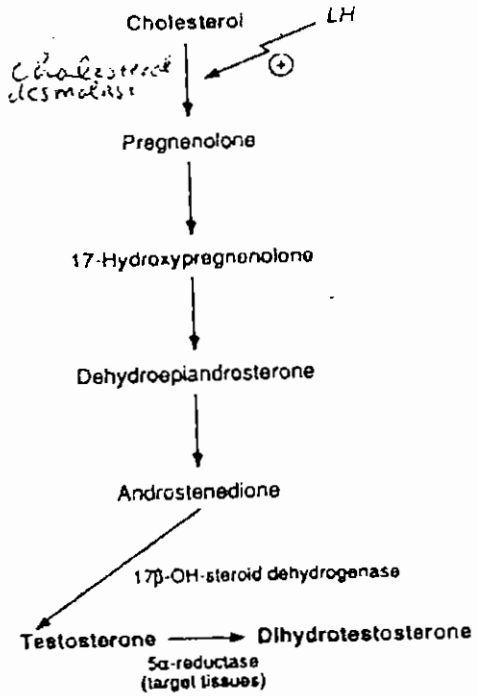


Figure 7-16. Synthesis of testosterone.

present in groups embedded in loose connective tissue between the seminiferous tubules

Interstitial cells (Leydig cells)

large + polyhedral, with extensive eosinophilic cytoplasm

eccentric nucleus

surrounded by plexuses of blood capillaries

ultrastructural features closely resemble those of the steroid secreting cells of the adrenal cortex

controlled by LH (used to be called ICSH → = interstitial cell stimulating hormone =

TABLE 10–1. Actions of Androgens on Target Tissues

Mediated by Testosterone	Mediated by Dihydrotestosterone
Differentiation of epididymis, vas deferens, and seminal vesicles	Differentiation of penis, scrotum, and prostate
Increased muscle mass	Male hair pattern
Pubertal growth spurt	Male pattern baldness
Cessation of pubertal growth spurt (epiphyseal closure)	Sebaceous gland activity
Growth of penis and seminal vesicles	Growth of prostate
Deepening of voice	
Spermatogenesis	
Negative feedback on anterior pituitary	
Libido	

Synthesis of testosterone (Figure 7-16)

- Testosterone is the major androgen synthesized and secreted by the **Leydig cells.**
- Leydig cells do not contain 21β-hydroxylase or 11β-hydroxylase (in contrast to the adrenal cortex) and do not synthesize glucocorticoids or mineralocorticoids.
- LH increases testosterone synthesis by stimulating cholesterol desmolase.
- **Accessory sex organs contain 5α-reductase,** which converts testosterone to dihydrotestosterone (the active form).
- **5α-reductase inhibitors (finasteride)** may be used in the treatment of **benign prostatic hypertrophy** because they block the activation of testosterone to dihydrotestosterone in the prostate.

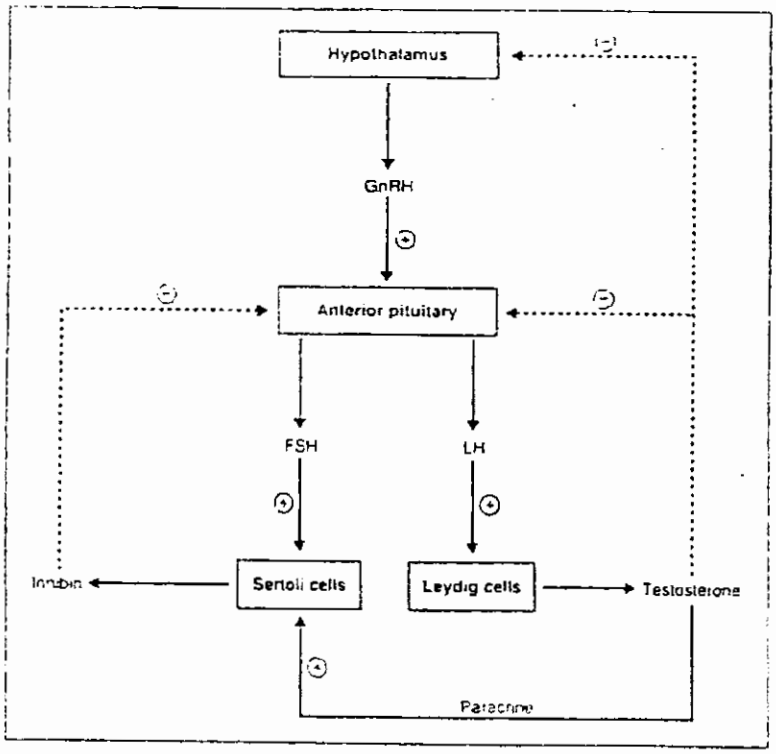


FIGURE 10–6. Control of gonadotrophin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH) secretion in males.

Regulation of testes (Figure 7-17)

1. Hypothalamic control—GnRH

–Arcuate nuclei of the hypothalamus secrete GnRH into hypophysial–portal blood. GnRH stimulates the anterior pituitary to secrete FSH and LH.

2. Anterior pituitary—FSH and LH

–**FSH acts on the Sertoli cells** to maintain **spermatogenesis**. The Sertoli cells also secrete **inhibin**, which is involved in feedback inhibition of FSH secretion.

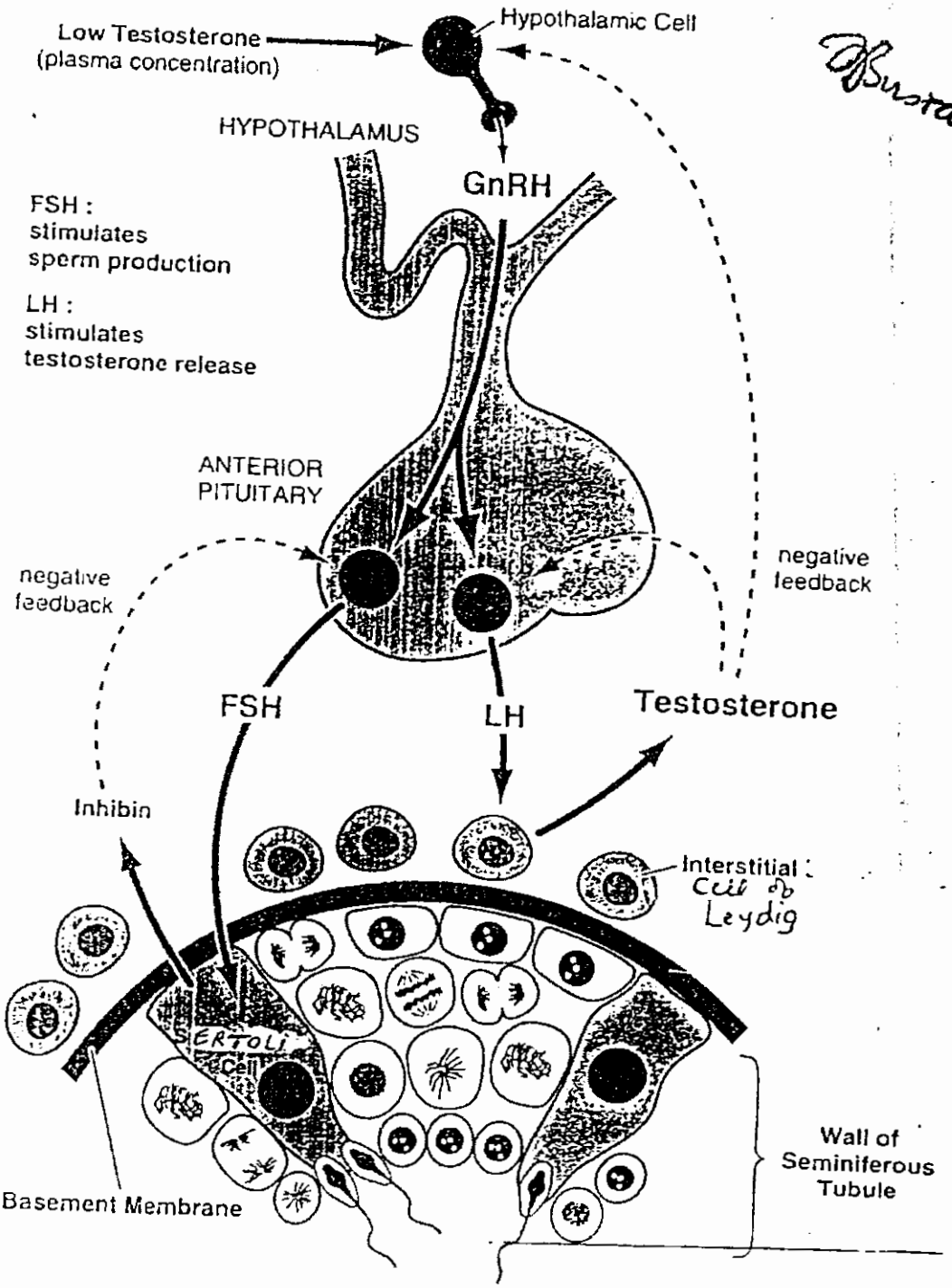
–**LH acts on the Leydig cells** to promote **testosterone synthesis**. Testosterone acts via an intratesticular paracrine mechanism to mediate the effects of FSH on spermatogenesis in the Sertoli cells.

3. Negative feedback control—testosterone and inhibin

–**Testosterone inhibits secretion of LH** by inhibiting release of GnRH from the hypothalamus and by directly inhibiting release of LH from the anterior pituitary.

–**Inhibin** (produced by Sertoli cells) **inhibits secretion of FSH** from the anterior pituitary.

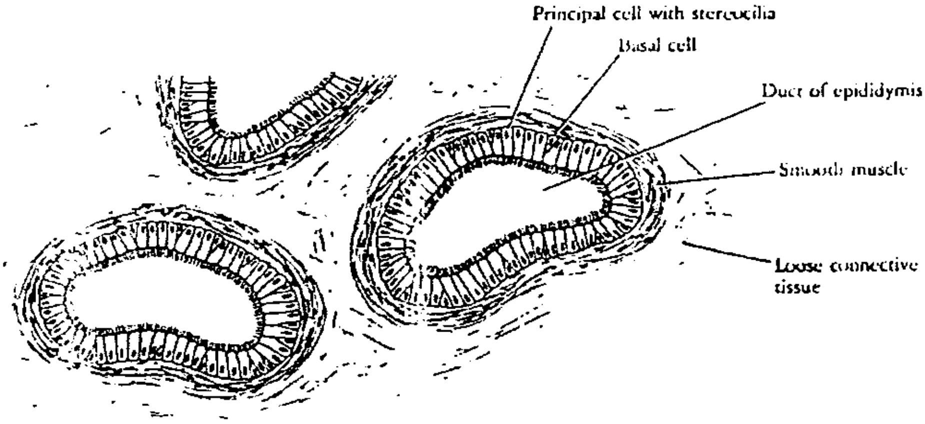
MALE REPRODUCTIVE HORMONES



<Epididymis>

Histology et Repro 1994

(15)



Efferent ductules → held together by loose C.T to form masses Known as ➡ Lobules of epididymis
↓
ductules join to form a single duct → Duct of epididymis *
↓
coiled to form body & tail of epididymis
↓
6 m

Duct of epididymis
- → Lumen → Spermatozoa
- → Lining → PS. St. Col.
  - → Basal cells → round nuclei (rest on basement membrane)
  - → Principal cells → oval nuclei
    - ↓ Possess extremely long microvilli → often called Stereocilia
  - → Basement membrane
- → Smooth muscles → Thin
  - → circular in the head
  - → 3 multidirectional in the tail

Function
- absorption of fluid by the long microvilli of the principle cells
- Storage + maturation of spermatozoa
- phagocytic ?

Dr. Bustami
Histology 1st Lecture
1999

Vas deferens → begins as a continuation of the duct of the epididymis
→ ends → form ampulla → joins the duct of the seminal vesicle to form the ejaculatory duct

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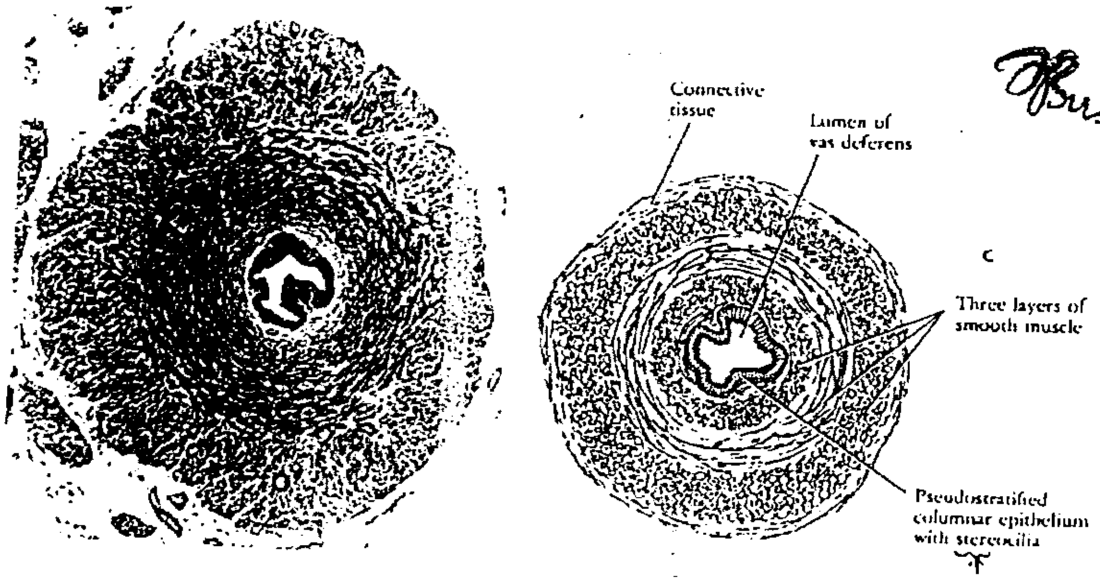
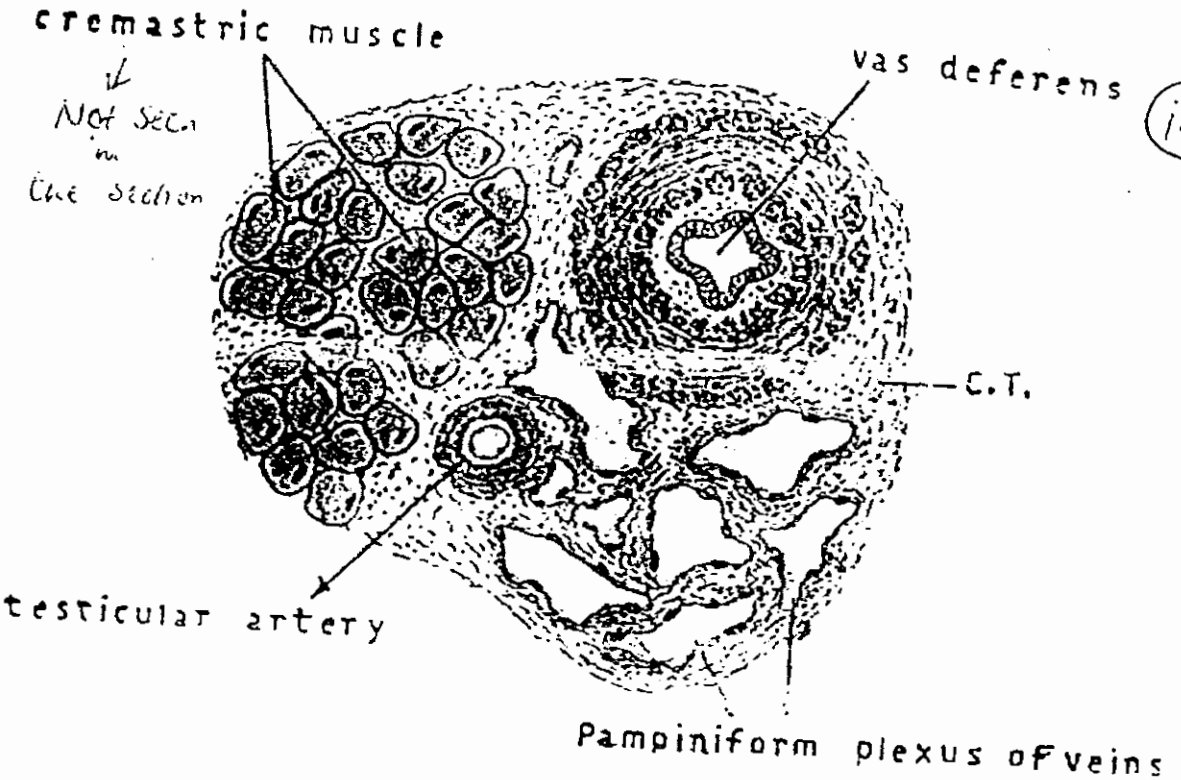


Vas deferens
- Mucosa → forms longitudinal folds
  - Epithelium → Pseudostratified columnar with Stereocilia
  - lamina propria
- Musculosa
  - outer → longitudinal
  - middle → circular
  - inner → longitudinal
- Adventitia
  - thick C.T
  - supports B.V & nerves

Function → during ejaculation → by Peristalsis convey Spermatozoa from epididymis to ejaculatory duct (the smooth muscles are richly supplied by Sympathetic fibres)



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Spermatic Cord

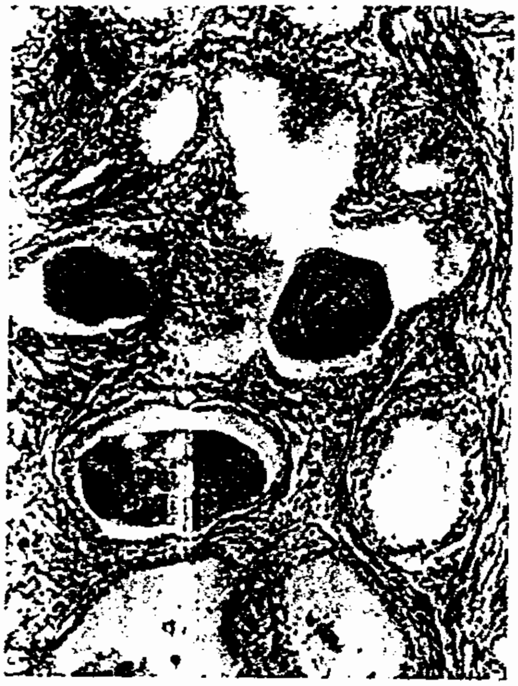
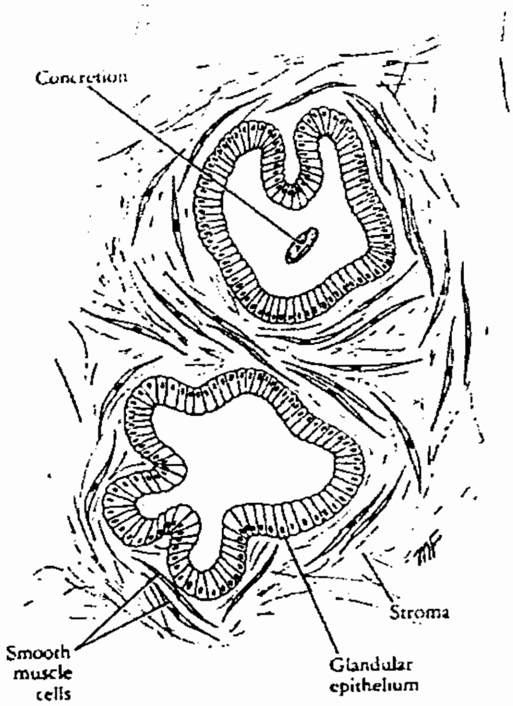


Fig. 14-27. Photomicrograph of a portion of the prostate removed from an old man. Note several concretions in the lumina of the glands. (H&E; × 100.)



Dr. Bustami Histology & Reproduction 1994 14.

18

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Prostate → Stroma → fibromuscular < supporting stroma / Capsule

Prostate → glands → tubulo-alveolar
→ majority open into the prostatic sinuses on either side of the urethral crest
→ at the periphery → large & branched
→ " " inner zone → smaller submucous glands
→ " mucosal glands

Epithelium → Columnar ???
→ show papillary elevations

Varies from INACTIVE LOW CUBOIDAL to ACTIVE PSUEDOSTRATIFIED COLUMNAR depending on the degree of stimulation by androgens from the testis

ducts – lined by 2 layers of epithelium < inner columnar / outer cuboidal

lumen → form amorphous masses called corpora amylacea

Prostatic concretions or prostatic salts

with ↑ age progressively calcified

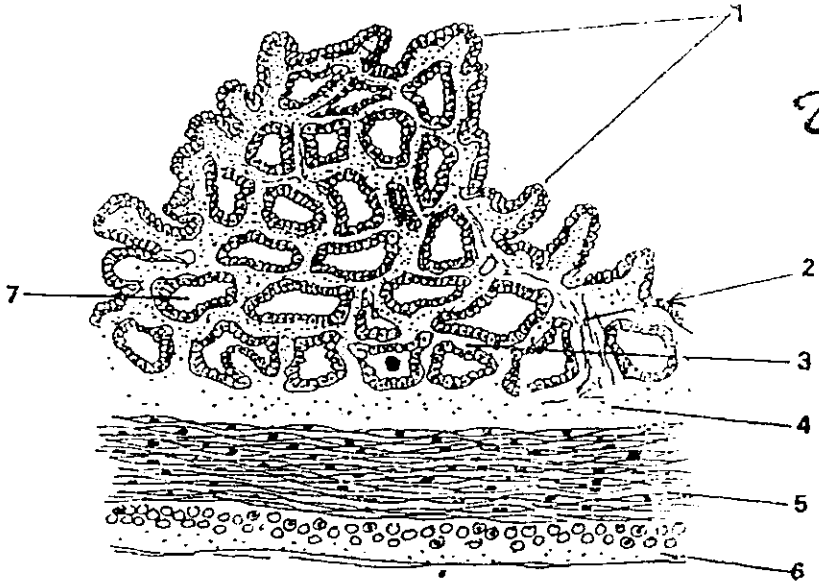


Fig. 89. Seminal Vesicle (T.S.)

1. Glandular Epithelium
2. Primary Fold in Mucosa
3. Secondary Fold in Mucosa
4. Lamina Propria
5. Muscular Coat
6. Adventitia
7. Crypts in the Mucosa

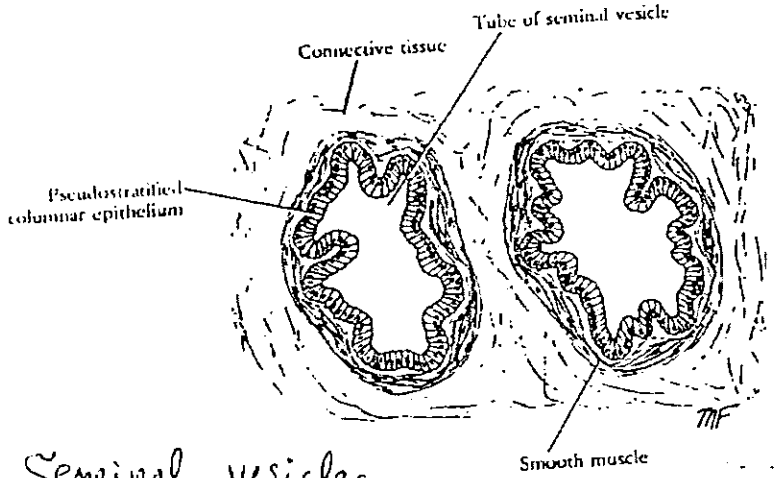
B. Bustanji Histology 1994

Bustanji (19) [redacted] 24

The (Prostaglandins) released from the seminal vesicles into the seminal fluid assist fertilization in 2 ways:

① react with cervical mucus to make it more penetrable by Sperm

② induce peristaltic contractions in the female reproductive tract (uterus fallopian tubes) to propel the sperm up the tract



Seminal vesicles → much-coiled tube embedded in connective tissue

① → Mucous membrane → thrown into (many complex folds)
→ lined by → usually Pseudostratified Colum. epith. (but may be columnar)

② → muscular coat (contract during ejaculation) → inner circular
→ outer longitudinal

③ → fibrous coat → loose C.T.

Function → controlled by testosterone
→ Secretion → contribute to seminal fluid
→ contains → fructose, ascorbic acid, amino acids, prostaglandins } for nourishment of Spermatozoa

FSH → stimulates Sertoli cell to Produce Stem cell factor → interacts with a specific receptor on the spermatogonium (c-kit)

This factor stimulates mitosis and inhibits apoptosis (Programmed cell death) of spermatogonia, thereby increasing their number

Activin → Protein hormone produced by Sertoli cell
→ stimulates spermatogonia to form Primary Spermatocytes

Sertoli cells → stimulated by FSH to Synthesize estradiole from testosterone (Produced by leydig cells)

FSH stimulates the production of androgen binding protein (ABP) → complexed with high affinity to testosterone, DHT & estradiole

This protein concentrate the sex steroids in the Sertoli cells to be used during Spermatogenesis

Germ cells lack androgen receptors !!!
↓
testosterone + other sex steroids bound to ABP can enter the germ cells by endocytosis

ABP is also secreted into the tubular fluid to keep high concentration of testosterone

DJ Sivarami

Local feedback loops operate within & between the
- Sertoli cells
- leydig cells
- peritubular cells

↓

FSH → Stimulate inhibin B & estradiol production

↓

inhibin feedback to BLOCK AROMATASE enzyme necessary for estradiole synthesis

---

Testosterone from the leydig cells stimulate inhibin Secretion by the sertoli cells

↓ Whereas

activin & estradiole from the sertoli cells feedback Negatively to block testosterone synthesis in the leydig cells

---

Testosterone also Stimulates the differentiation of peritubular cells

↓

secrete proteins similar to sertoli cells ??

Uterus

Synonyms

1. Womb; 2. Hystera (G). Compare with the terms hysterotomy and hysterectomy.

Definition

Uterus is a child-bearing organ in females, situated in the pelvis between bladder and rectum. Though hollow it is thick-walled and firm, and can be palpated bimanually during a PV (per vaginum) examination.

Shape and Size

It is piriform in shape, being flattened from before backwards. The upper expanded part is called the body, and the lower cylindrical part, the cervix. The circular constriction between the body and cervix corresponds to internal os. This constriction is often named as isthmus, although in strict sense the 'isthmus' is formed by the upper 1/3 (nearly 0.8 cm) of cervix which resembles uterus in its structure and forms the *'lower uterine segment'* of the obstetricians. It is so named because during second month of pregnancy, it is gradually taken up into the body of the uterus. During labour the 'lower segment' becomes stretched and elongated to form the 'conducting' part of the uterus. Whereas the 'upper segment' forms the propulsive part.

Uterus is 3 inches long, 2 inches broad and 1 inch thick. It weighs about 30-40 g.

Communications

Superiorly, uterus communicates on each side with the uterine tube, and inferiorly, with the vagina.

Normal Position and Angulations

Normally the uterus is *anteverted and anteflexed.* Forward angulation between the cervix and vagina is called the angle of anteversion (about 90 degrees). Similarly, the slight forward angulation between the body and cervix is called the angle of antefixion (120-125 degrees). Roughly, the long axis of uterus corresponds to the axis of the pelvic inlet, and the axis of vagina, to the axes of the pelvic cavity and pelvic outlet.

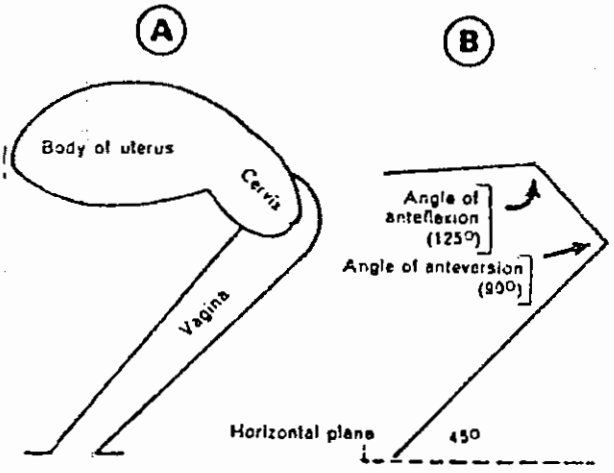
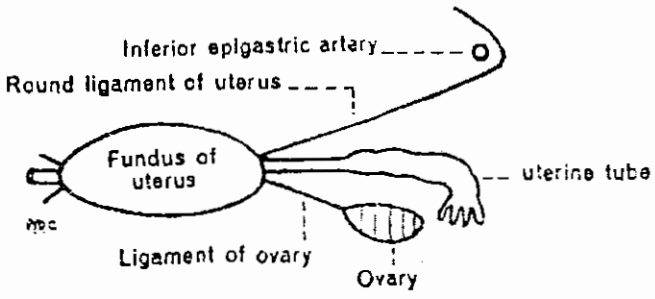


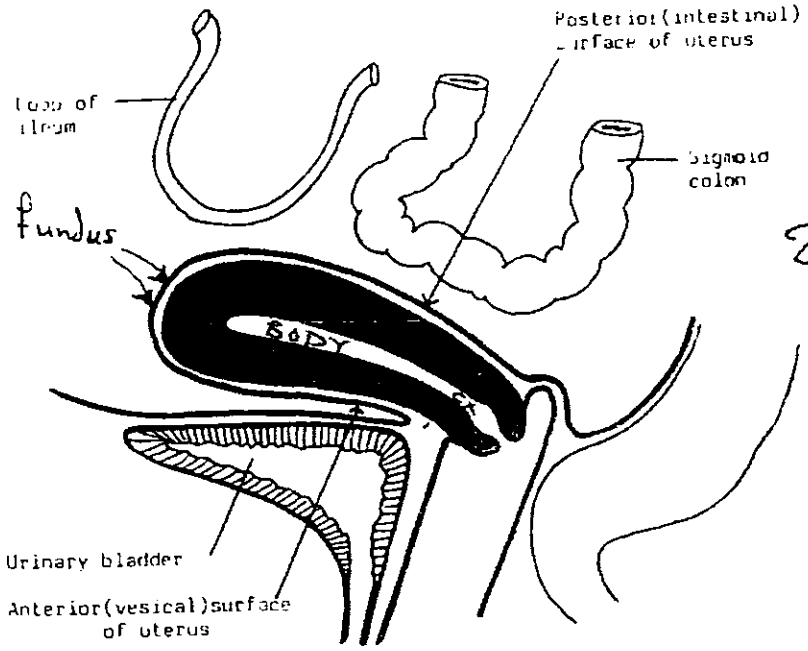
Fig. 327 Angulations of the uterus and vagina (A), and their axes (B).

Gross Features

As already indicated the uterus is divided into a body (upper 2/3, or 2 inches) and a cervix or neck (lower 1/3, or 1 inch).



(C) Superior view of the fundus of uterus after pulling it backwards. Note the attachments of the uterine tube, round ligament of uterus and the ligament of ovary to the superior angle of uterus.



Relations of the uterus

A. Body of Uterus

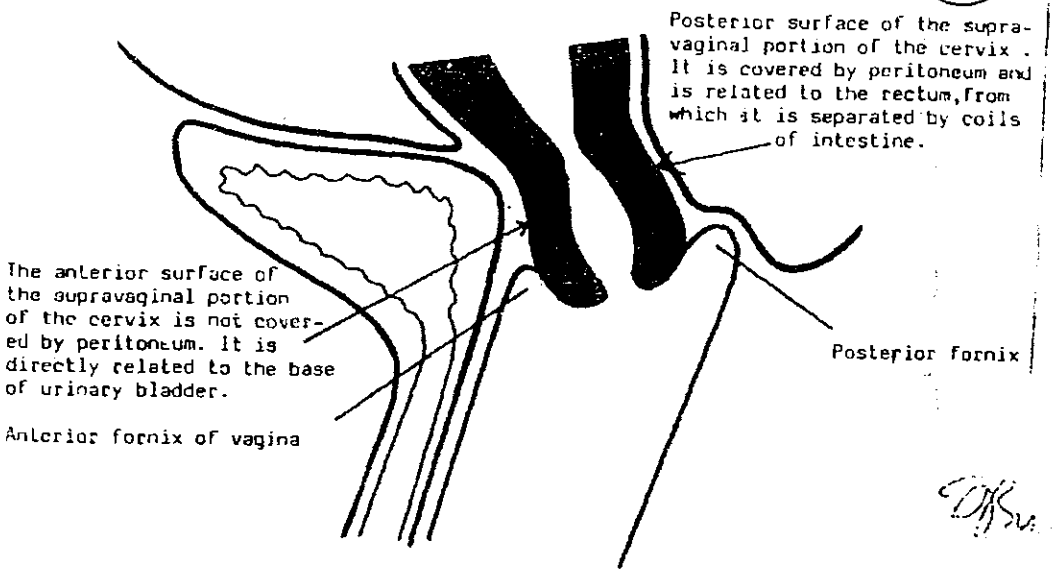
The body has: (a) a fundus; (b) two surfaces, anterior or vesical and posterior or intestinal; and (c) two lateral borders.

The *fundus* is convex like a dome. It is covered with peritoneum and is directed forwards when the bladder is empty. The fertilized ovum is implanted usually in the posterior wall of fundus.

Anterior or vesical surface is flat and related to urinary bladder. It is covered with peritoneum and forms the posterior (superior) wall of the vesicouterine pouch.

Posterior or intestinal surface is convex and related to terminal coils of ileum and sigmoid colon. It is covered with peritoneum and forms the anterior wall of the rectouterine pouch.

Each *lateral border* is rounded and convex. It provides attachment to the broad ligament of uterus which extends to the lateral pelvic wall. Uterine tube opens into the uterus at the upper end of this border. Anteroinferior to the tube the round ligament of uterus is attached, and posteroinferior to the tube the ligament of ovary is attached. Uterine artery ascends along the lateral border of uterus between the two layers of the broad ligament.



Peritoneal coverings and relations of the cevix

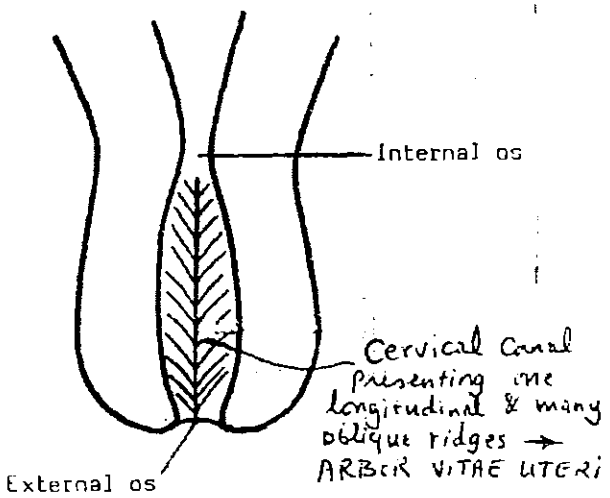
B Cervix of Uterus

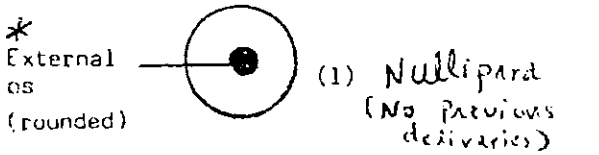
Cervix is the lower, cylindrical part of the uterus which is less mobile than the body. It is about 2.5 cm long, and is slightly wider in the middle than at either end. The lower part of cervix projects into the anterior wall of the vagina which divides it into the supravaginal and vaginal parts.

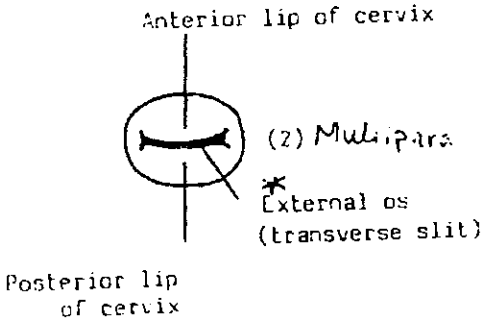
The *supravaginal part of cervix* is related; (a) anteriorly to bladder; (b) posteriorly to rectouterine pouch with intestinal coils, and the rectum; and (c) on each side, to ureter and uterine artery embedded in parametrium. The, fibrofatty tissue between the two layers of the broad ligament and below it is called parametrium; it is most abundant near the cervix and vagina.

The *vaginal part of cervix* projects into the anterior wall of vagina forming the vaginal fornices. Cervical canal opens into the vagina by an opening called the *external os*. In a nulliparous woman the external os is small and circular. However, in multiparous women, the external os is bounded by the anterior and posterior lips, both of which are in contact with the posterior wall of vagina.

The *cervical canal* is fusiform in shape, being flattened from before backwards. It communicates above with the uterine cavity through the internal os, and below with the vaginal cavity through the external os. The mucosal folds in the anterior and posterior walls of the canal resemble the branches of a tree (*arbor vitae uteri*) which interlock with each other and close the canal.







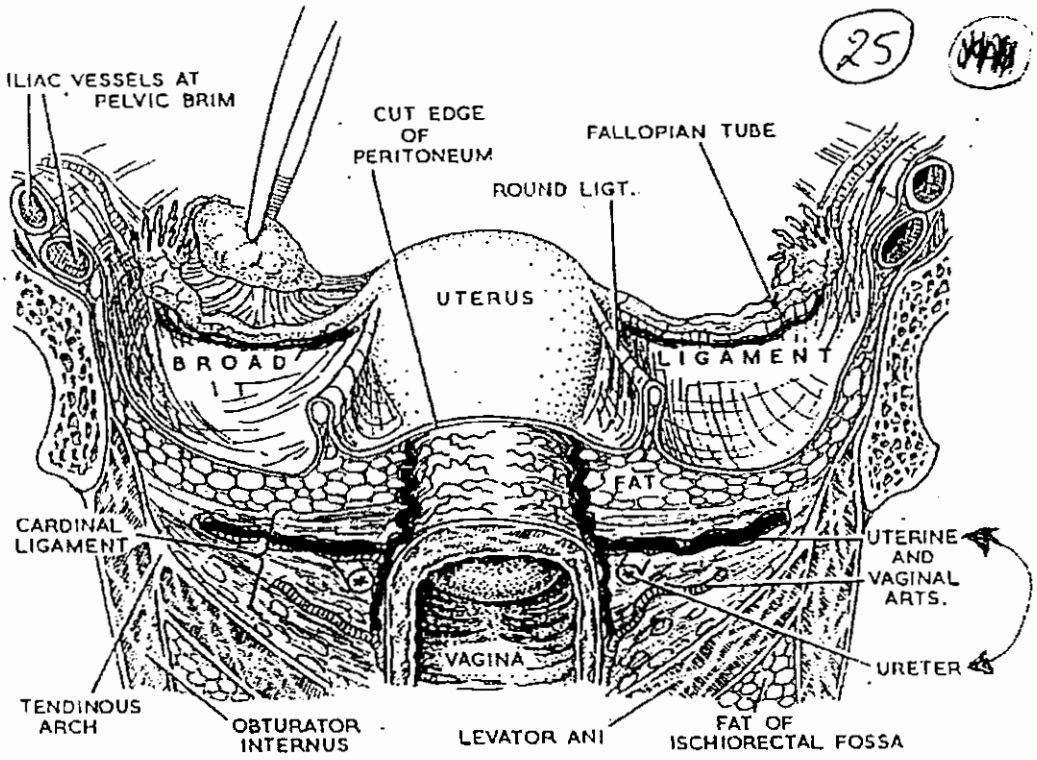
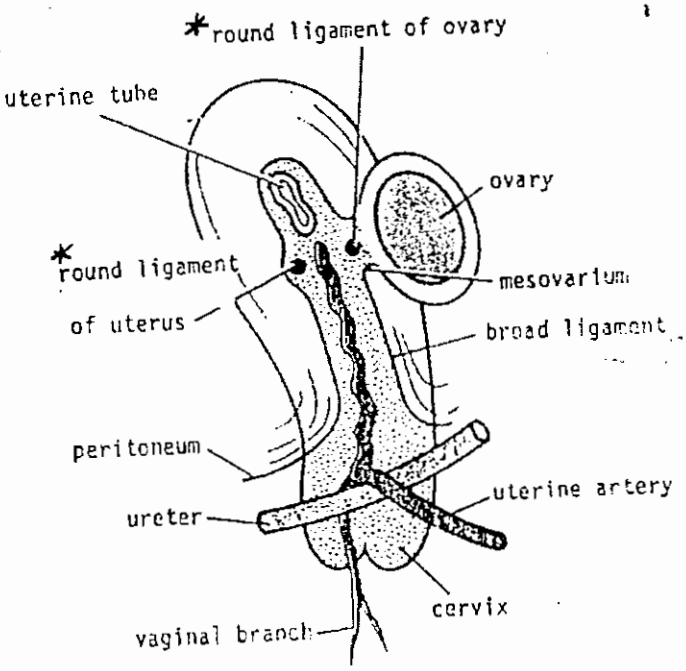
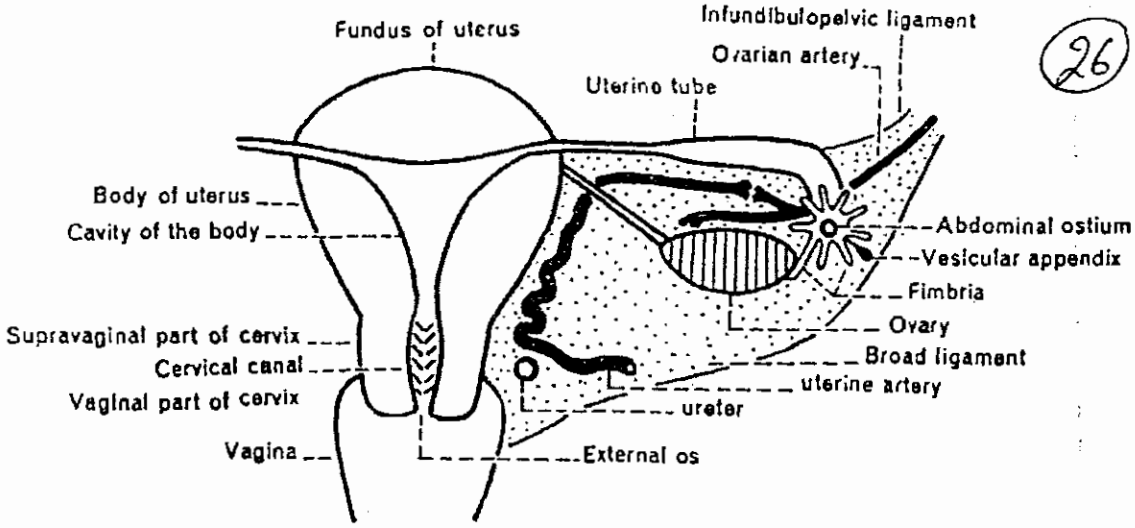


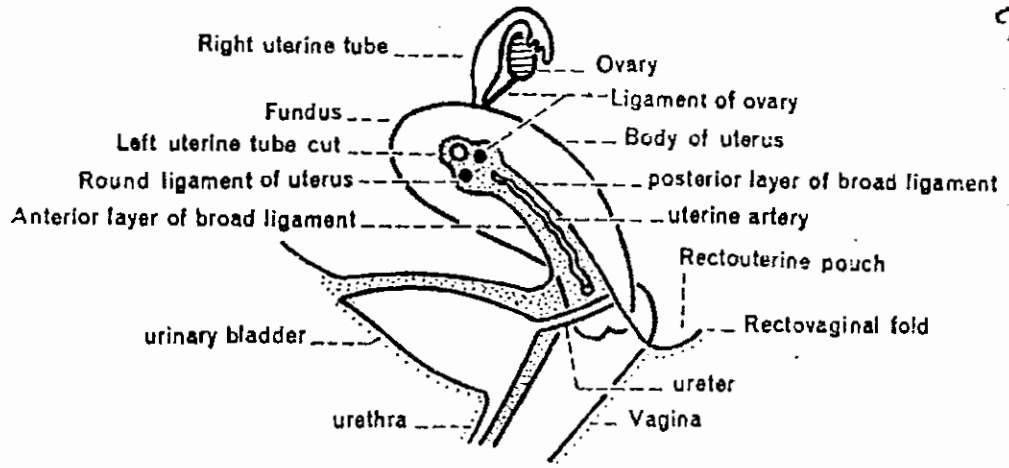
Fig. 1.6 Coronal section of female pelvis, viewed from in front.

Broad ligaments are two broad folds of peritoneum which suspend the uterus to the lateral pelvic wall. When bladder is full, the ligament has anterior and posterior surfaces and a free upper border; the other three borders (inferior, medial and lateral) are attached to pelvic floor, uterus and lateral pelvic wall. Broad ligament is divided into: (a) mesosalpinx, between the tube and ovarian ligament; (b) mesometrium, below the ovarian ligament; (c) infundibulopelvic ligament (p. 274); and (d) mesovarium (p. 274) Broad ligament contains the following structures (Fig. 328).



1. *One tube.* Uterine tube in the free upper border.
2. *Two ligaments.* (a) Round ligament of uterus bulges out the anterior layer. (b) Ligament of ovary bulges out the posterior layer.
3. *Two vessels.* (a) Uterine vessels near the uterus. (b) Ovarian vessels in the infundibulopelvic ligament.
4. *Two nerves:* (a) Uterovaginal plexus. (b) Ovarian plexus.
5. *Two embryological remnants.* (a) Epoophoron and the duct of epoophoron (Gartner's duct). (b) Paroophoron.
6. *Two miscellaneous structures.* (a) Lymphatics and lymph nodes. (b) Fibroareolar tissue or parametrium.





Arterial Supply

Uterus is supplied: (1) chiefly by the two uterine arteries which are markedly enlarged during pregnancy; and (2) partly by the ovarian arteries.

Uterine artery is a branch from the anterior division of internal iliac artery. First it runs medially towards the cervix, crossing the ureter above the lateral fornix of vagina and 2 cm lateral to cervix. Then 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 tortuosity of the artery permits expansion of uterus during pregnancy. Uterine artery supplies: (1) uterus, by helicine arteries; (2) vagina, by the anterior and posterior azygos arteries of vagina; (3) medial 2/3 of uterine tube; (4) ovary; (5) ureter; and (6) contents of the broad ligament.

Venous Drainage

Veins form a plexus along the lateral border of the uterus. The plexus drains through the uterine, ovarian and vaginal veins into the internal iliac veins.

Arterial Supply

1. *Ovarian artery* arises from the abdominal aorta just below the renal artery. It descends over the posterior abdominal wall and enters the suspensory ligament of ovary. It sends branches to the ovary through the mesovarium, and continues medially through the broad ligament of uterus to anastomose with the uterine artery. In addition to ovary, the ovarian artery also supplies the uterine tube, side of the uterus and the ureter.

2. Uterine artery gives additional branches which reach the ovary through the mesovarium. The arteries passing through the mesovarium in the medulla of ovary have a convoluted course, and become spiral in the cortex.

Venous Drainage

Veins emerge at the hilus and form a pampiniform plexus on the artery. The plexus condenses into a single vein near the pelvic inlet. The ovarian vein ascends in the posterior abdominal wall and drains into the inferior vena cava on right side and into the left renal vein on the left side.

Supports of Uterus

Uterus is a mobile organ which undergoes extensive changes in size and shape during reproductive period of life. It is supported and prevented from sagging down by a number of factors which are chiefly muscular and fibromuscular.

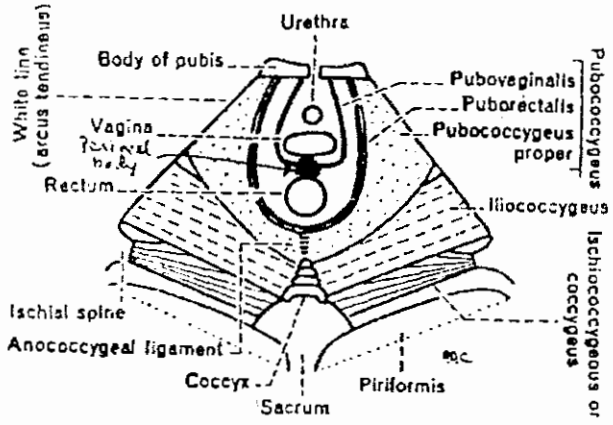
Classification

1. Primary Supports
   - A. Muscular or active
     1. Pelvic diaphragm
     2. Perineal body
     3. Urogenital diaphragm
   - B. Fibromuscular or mechanical
     1. Uterine axis
     2. Pubocervical ligament
     3. Transverse cervical ligament
     4. Uterosacral ligament
     5. Round ligament of uterus.

Role of Individual Support

(1) *Pelvic diaphragm* (Fig. 239)

It supports the pelvic viscera and resists any rise in the intra-abdominal pressure. The pubococcygeous part of levator ani (Chapter 58) is partly inserted into the perineal body between the vagina and rectum. Some of these fibres also form a supporting sling and a sphincter for the vagina, and so indirectly for the uterus and bladder. If pubococcygeous is torn during parturition, the vaginal support is lost, and it tends to sink into the vestibule along with the uterus, thus causing the prolapse of uterus. The anterior vaginal wall is poorly supported by the muscle, and therefore is more liable to prolapse than the posterior wall. The efficacy of levator ani as a support is also lost when the perineal muscles are torn, which normally fix the perineal body and make it an anchor for the levator ani.



(2) *Transverse Cervical Ligaments* (of Mackenrodt)

These are also known as: (a) lateral cervical ligaments; (b) cardinal ligaments; (c) Mackenrodt's ligaments (d) paracervical ligaments; (e) retinacula uteri; and (f) sustentaculum of Bonny.

They are fan-shaped condensations of the pelvic fascia on each side of cervix above the levator ani and around the uterine vessels. They connect the lateral aspects of cervix and upper vaginal wall to the lateral pelvic wall 1 inch ventral to ischial spine. They act as a 'hammock' in the support of the uterus.

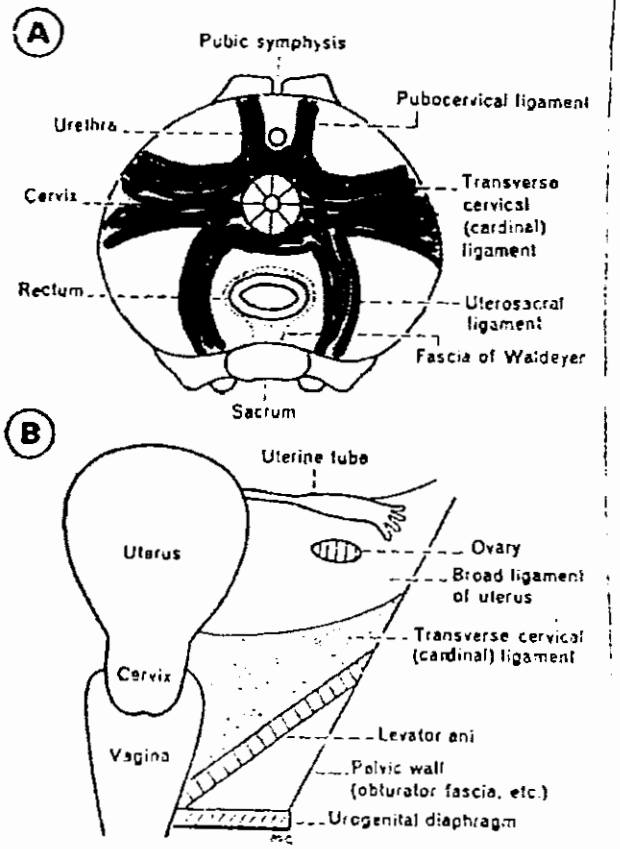


Fig 331 Condensations of pelvic fascia forming the supports of the pelvic organs. (A) Superior view of the ligamentous supports of uterus and rectum. (B) Coronal view of the right cardinal ligament.

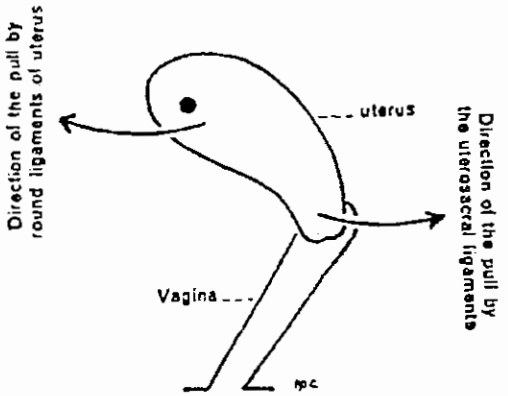


Fig. 330 Anteverson of uterus is maintained by the couple of forces provided by the pulls of uterosacral and round ligaments of uterus.

4. *Uterine Axis*

The anteverted position of uterus itself pr vents the organ from sagging down through tl vagina. Any rise in intra-abdominal pressu tends to push the uterus against the bladd and pubic symphysis, which further accentuat anteversion. The angle of anteversion is mai tained by the uterosacral and round ligament

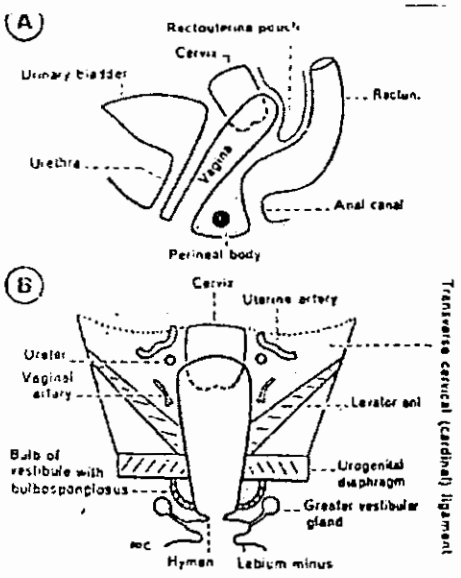


Fig. 333 Relations of vagina. (A) Left view of a sagittal section of female pelvic organs after removing the body of uterus; and (B) a coronal section of the female pelvis through the vagina with uterine cervix.

Nerve Supply

1. Lower 1/3 of vagina is pain sensitive and is supplied by pudendal nerve through the inferior rectal and posterior labial branches of perineal nerve.

2. Upper 2/3 of vagina is pain insensitive and is supplied by sympathetic ($L_{1,2}$) and parasympathetic ($S_{2,3}$) nerves derived as vaginal nerves (accompanying vaginal arteries) from the inferior hypogastric and uterovaginal plexuses. Sympathetic nerves are vasoconstrictor, and parasympathetic nerves vasodilator.

VAGINA

Ant. wall of vagina → 3" (8 cm)
Post. " " " → 4" (10 cm)

Relations

* Ant. wall — upper 1/2 → related to base of bladder
lower 1/2 → " " urethra

* Post. wall — upper 1/4 → separated from rectum by the pouch of Douglas
middle 2/4 → separated from rectum by loose C.T
lower 1/4 → separated from anal canal by the perineal body

* Lat. wall — upper 1/3 → Transverse cervical lig. in which embedded network of vag. vein + ureter crossed by uterine a.
Middle 1/3 → Pubococcygeal part of levator ani
lower 1/3 → Pierces the urogenital diaphragm below which it is related to bulb of vestibule + bulbospongiosus + Bartholin gland & greater vestibular glands

* lymph drainage — upper 1/3 → Ext. iliac L.N
middle 1/3 → Int. " "
lower 1/3 → medial group of superficial inguinal L.N.

Uterine Tubes

(Fallopian tubes)

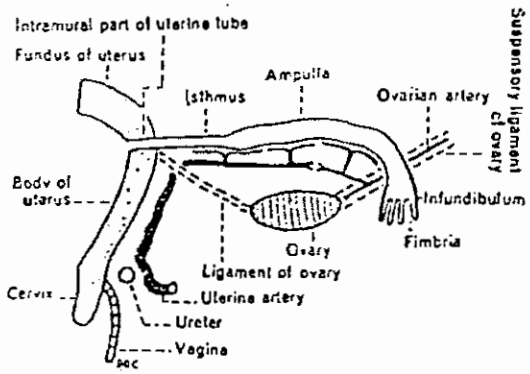
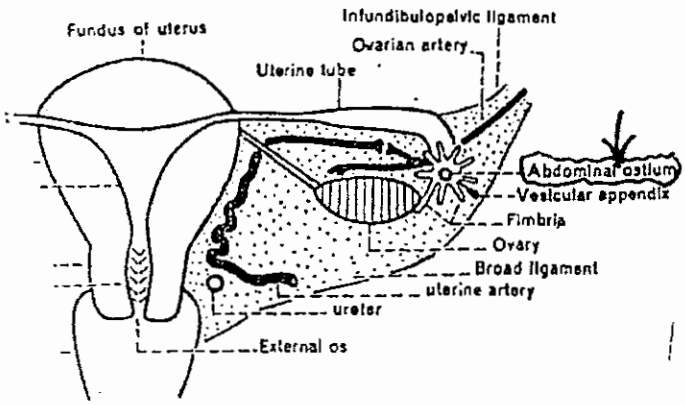


Fig. 314 The parts, relations and blood supply of the uterine tube.



Situation

These are situated in the free upper margin of the broad ligament of uterus.

Dimensions

Each tube is about 10 cm (4 in.) long. The diameter is about 3 mm at abdominal ostium, 4 mm at ampulla, 2 mm at isthmus, and 1 mm at the uterine (intramural) part.

Communications

Medially, the tube opens into the superior angle of the uterine cavity by a narrow (1 mm) *uterine ostium*.

Laterally, it opens into the peritoneal cavity close to the ovary by a wider (3 mm) *abdominal ostium*.

Parts

1. *Infundibulum* (*fimbriated end*) is the trumpet-shaped expansion of the lateral end of tube, which opens into the peritoneal cavity by *abdominal ostium*, and is broken up into a number of finger-like processes, called the *fimbriae*. One of these fimbriae is longer and more deeply grooved than the others, and is attached to the tubal pole of the ovary; it is known as *ovarian fimbria*.

The fimbriae are extensions of the mucosal folds. Their outer surface is covered by peritoneum but the inner surface is lined by ciliated columnar epithelium which guides the ovum to the ostium and then to the interior of the tube.

2. Ampulla → is the medial continuation of the infundibulum It is thin-walled, dilated & forms about lateral ⅔ of the tube. It arches over the upper pole of the ovary

3. Isthmus → succeeds the ampulla, it is narrow, cord-like & forms about medial ⅓ of the tube

4. uterine (interstitial or intramural) part of the uterine tube is about 1 cm long & 1 mm in diameter & lies within the wall of the uterus & opens into the superior angle of the uterine cavity by a narrow uterine ostium

Notice → the infundibulum projects beyond the free margin of the broad ligament.

Blood supply → uterine artery (from internal iliac a.) supplies about medial ⅔ & ovarian a. about lateral ⅓ of the uterine tube

Ovaries

Position (Orientation)

The position of the ovary is variable. In nulliparous women, its long axis is nearly vertical, so that the ovary is usually described to have an upper pole and a lower pole. However, in multiparous women, the long axis becomes horizontal; so that the upper pole points laterally and the lower pole medially.

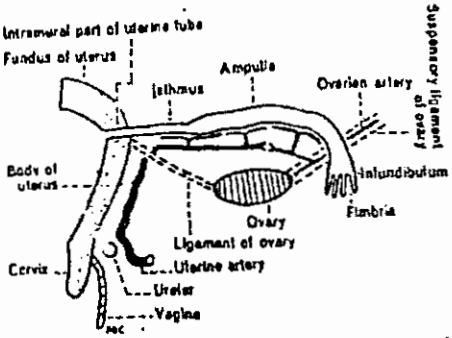
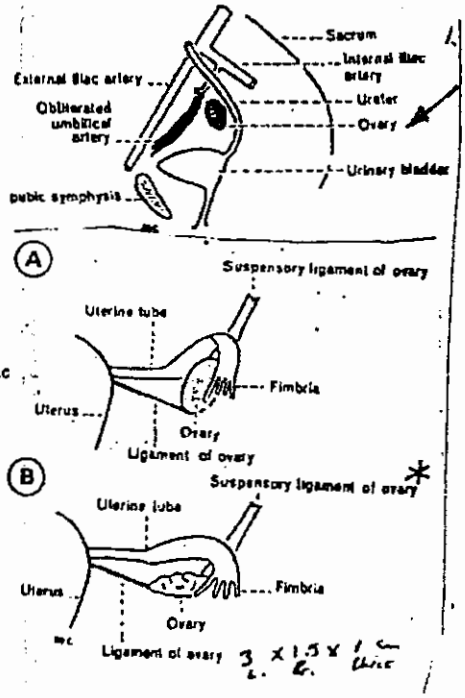


Fig. 314 The parts, relations and blood supply of the uterine tube.



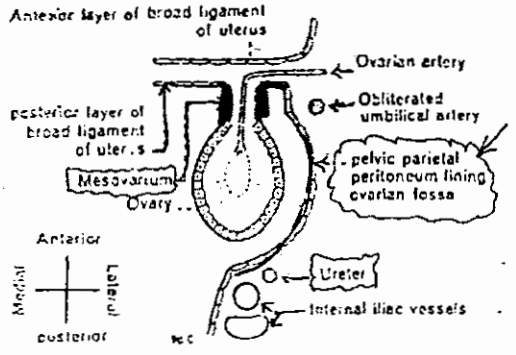


Fig. 313 Superior view of a horizontal section through the right ovarian fossa and the lateral part of the broad ligament of uterus.

Arterial Supply

1. *Ovarian artery* arises from the abdominal aorta just below the renal artery. It descends over the posterior abdominal wall and enters the suspensory ligament of ovary. It sends branches to the ovary through the mesovarium, and continues medially through the broad ligament of uterus to anastomose with the uterine artery. In addition to ovary, the ovarian artery also supplies the uterine tube, side of the uterus and the ureter.

Situation

Each ovary lies in the ovarian fossa on the lateral pelvic wall. The fossa is bounded : (a) anteriorly by the obliterated umbilical artery; and (b) posteriorly by the ureter and internal iliac artery (Fig. 311).

The ovary is attached to the posterior or upper layer of the broad ligament of uterus, and lies just below and behind the lateral ampullary) part of the uterine tube, on each side of the uterus.

A. Peritoneal Relations

Ovary is almost entirely covered with peritoneum, except along the mesovarian (anterior) border where the two layers of the covering peritoneum are reflected on to the posterior layer of the broad ligament of uterus. Thus the ovary is connected to the posterior layer of the broad ligament by a short fold of peritoneum, called *mesovarium*. The squamous epithelium of the mesovarium is continuous with the cubical epithelium of the ovary. The mesovarium transmits the vessels and nerves to and from the ovary (Fig. 313).

The lateral part of the broad ligament of uterus, extending from the infundibulum of the tube and upper pole of ovary to the external iliac vessels, forms a distinct fold, known as the *suspensory ligament of ovary* (*infundibulopelvic ligament*). It contains the ovarian vessels and nerves.

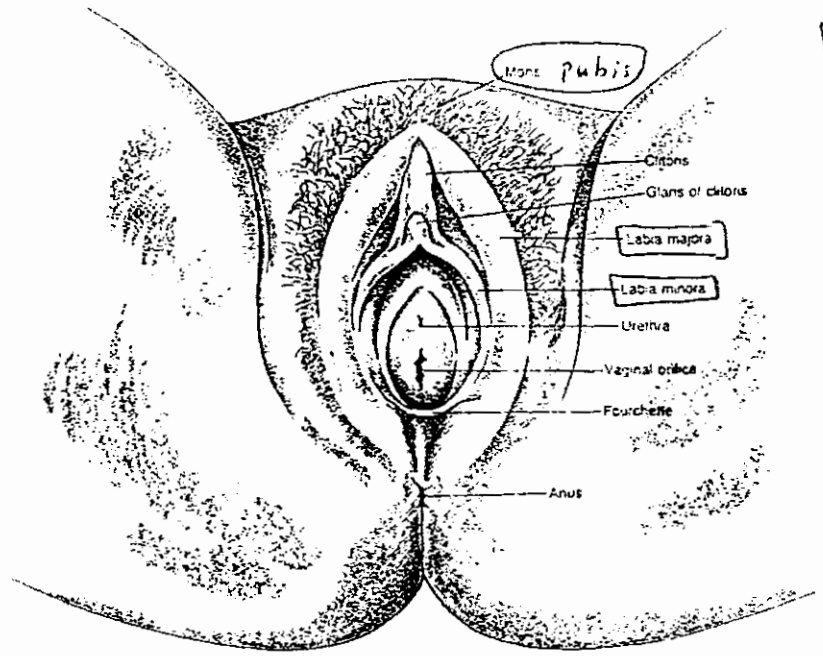


FIGURE 18–8. Features of female external genitalia. Labia majora and minora have been separated to show the deeper structures.

Vulva is the external genital organ of the female & is composed of:

1. Labia majora → 2 Prominent folds of skin filled with fat. The cleft between them is called Pudendal cleft
2. Labia minora → 2 thin folds of skin (no fat) present between the 2 labia majora → the interval between them is called the vestibule of the vagina
3. Clitoris → Resembles the penis in structure but is devoid of urethra. The body of the Clitoris is made up of 2 corpora cavernosa, the corpus spongiosum is absent
4. Within the vestibule of the vagina:
   a. External urethral orifice → lies immediately ANTERIOR to vaginal orifice but 2.5 cm behind the Clitoris
   b. vaginal orifice (introitus) → lies in the posterior part of the vestibule & is partly closed in the virgin by the hymen which is a perforated fold of mucous membrane
   c. Greater vestibular glands → one on each side of the vaginal orifice & overlapped by the bulb of the vestibule. Its duct opens on the side of the hymen

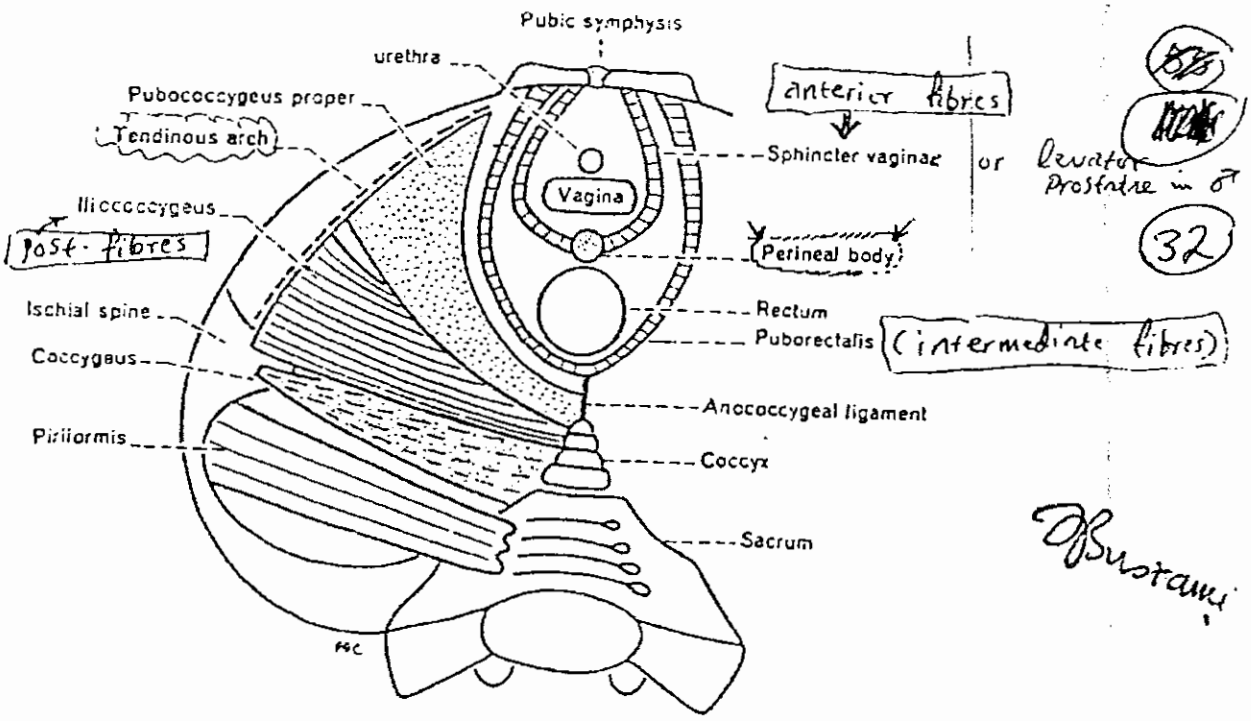


Fig. 345 The levator ani, coccygeus and piriformis in a female shown on the left side.

PELVIC DIAPHRAGM

The pelvic diaphragm is formed by the important levatores ani muscles and the small coccygeus muscles and their covering fasciae (Fig. 6-13). It is incomplete anteriorly to allow passage of the urethra in males and the urethra and the vagina in females.

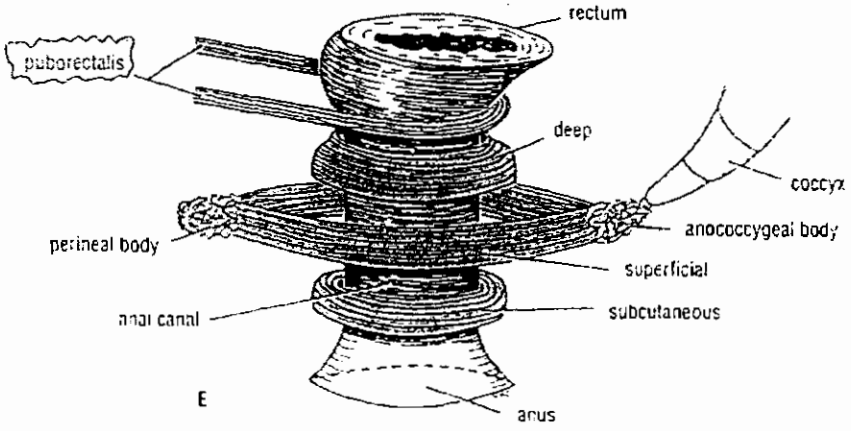
Levator Ani Muscle

The levator ani muscle is a wide thin sheet that has a linear origin from the back of the body of the pubis, a tendinous arch formed by a thickening of the pelvic fascia covering the obturator internus, and the spine of the ischium (Fig. 6-13). From this extensive origin, groups of fibers sweep downward and medially to their insertion (Fig. 6-14), as follows:

1. **Anterior fibers:** The **levator prostatae** or **sphincter vaginae** form a sling around the prostate or vagina and are inserted into a mass of fibrous tissue, called the **perineal body,** in front of the anal canal. The levator prostatae support the prostate and stabilize the perineal body. The sphincter vaginae constrict the vagina and stabilize the perineal body.
2. **Intermediate fibers:** The **puborectalis** forms a sling around the junction of the rectum and anal canal. The **pubococcygeus** passes posteriorly to be inserted into a small fibrous mass, called the **anococcygeal body,** between the tip of the coccyx and the anal canal.
3. **Posterior fibers:** The **iliococcygeus** is inserted into the anococcygeal body and the coccyx.

- **Action:** The levatores ani muscles of the two sides form an efficient muscular sling that supports and maintains the pelvic viscera in position. They resist the rise in intrapelvic pressure during the straining and expulsive efforts of the abdominal muscles (as occurs in cougning)

defecation & delivary (2nd stage)



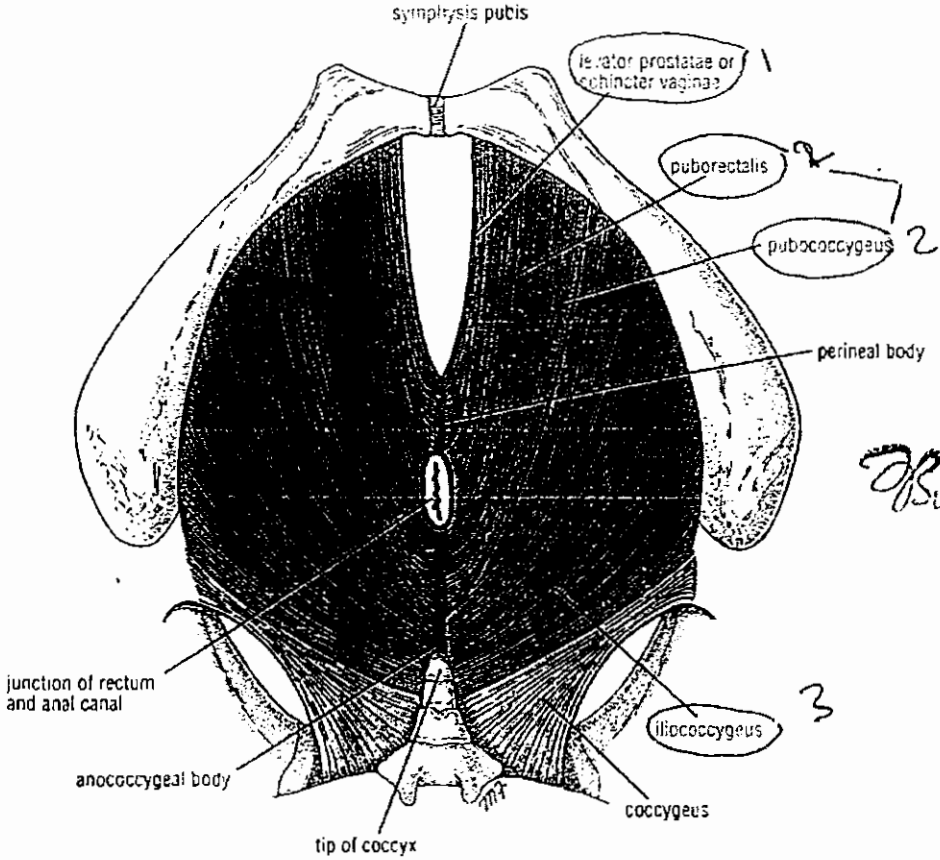


Figure 6-14 Levator ani muscle (*dark brown*) and coccygeus muscle (*light brown*) seen on their inferior aspects. Note that the levator ani is made up of several different muscle groups. The levator ani and coccygeus muscles with their fascial coverings form a continuous muscular floor to the pelvis, known as the pelvic diaphragm.

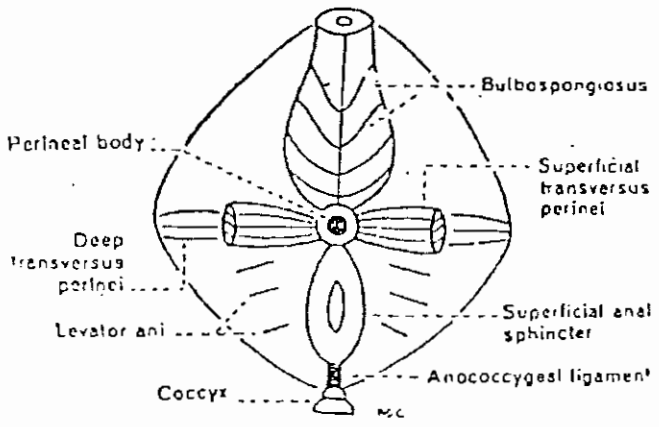


Fig. 291 The perineal body and the anococcygeal

4. *Perineal body* is one of the chief supports to the pelvic organs, like the uterus. In order to avoid its damage in a perineal tear, an episiotomy is often done in the primiparas. A damage to perineal body often leads to *prolapse of uterus* and other pelvic organs.

5. Perineal Body

The perineal body, or the central point of perineum, is a fibromuscular node situated in the median plane, about 1.25 cm in front of the anal margin and close to the bulb of penis. Nine muscles (three unpaired-external anal sphincter, bulbospongiosus and the unstriped fibres of the longitudinal muscle coat of rectal ampulla and anal canal; and three paired-superficial transversus perinei, deep transversus perinei, and levator ani) converge and interlace in the body (Fig. 291).

Perineal body is very important in females for the support of the pelvic organs. Its involvement in perineal tear during parturition may result in prolapse of the urinary bladder, uterus, ovaries and even rectum.

→ Perineum ← "Of Sustanu"

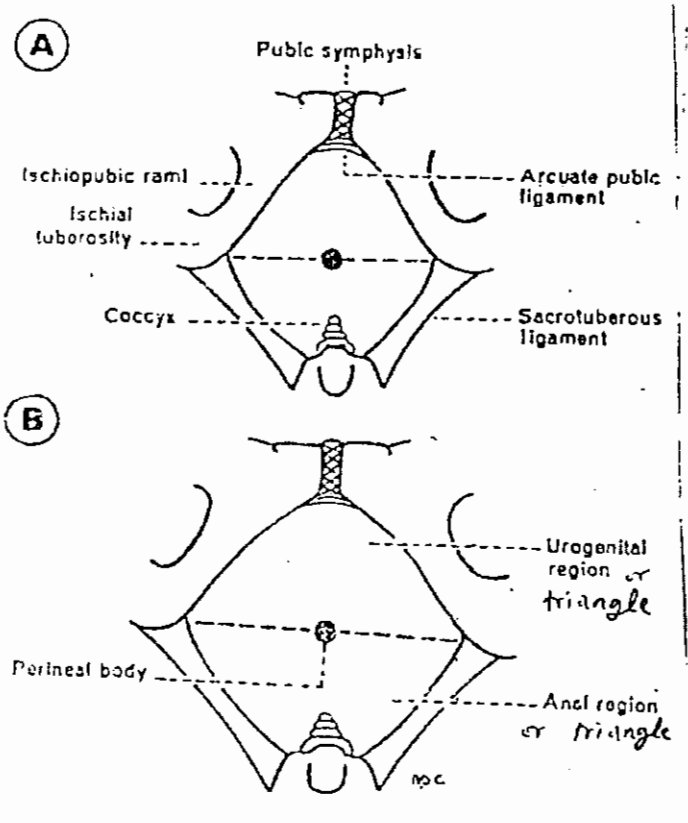
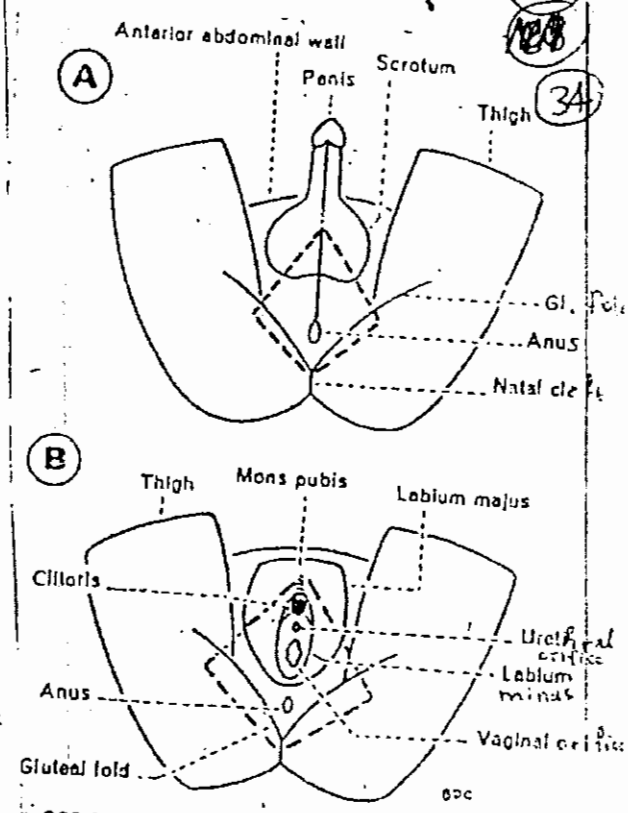


Fig. 290 Boundaries of perineum. (A) Male perineum and (B) female perineum. Interrupted line shows division of perineum into urogenital and anal regions.



. 289 Perineum seen in a lithotomy position. (A) or perineum; and (B) female perineum. The interrupted lines mark out the pelvic outlet.

Perineum is a diamond-shaped space that has the same boundaries as the inferior pelvic aperture (IPA) → Pelvic outlet

↓

Superficial boundaries

- Anteriorly → scrotum in males / mons pubis in females
- Posteriorly → Buttocks
- on each side → upper part of the medial side of thigh

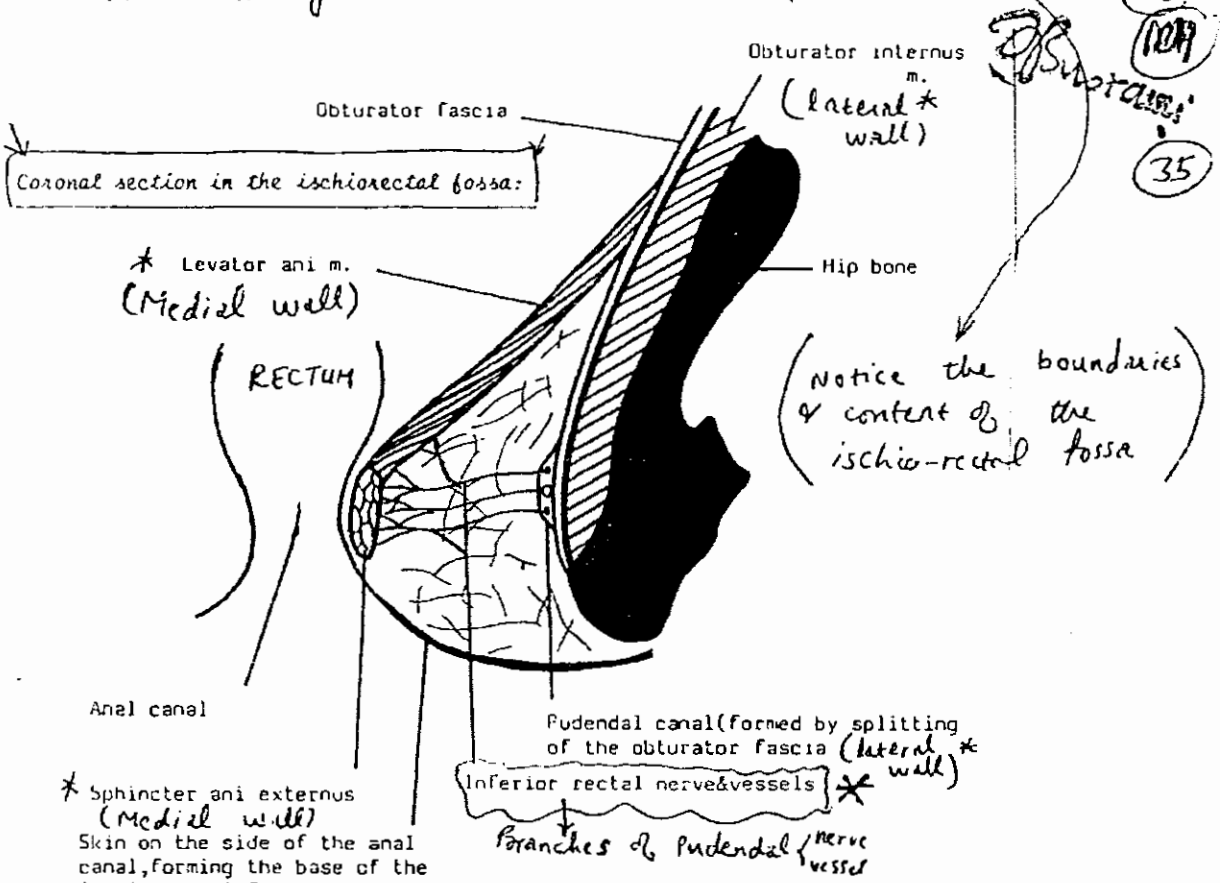
Deep boundaries → Same as those of Pelvic outlet

- Anteriorly → arcuate (inferior) Pubic ligament
- Posteriorly → tip of coccyx
- on each side → conjoined ischio-pubic rami / ischial tuberosity / Sacrotuberous ligament

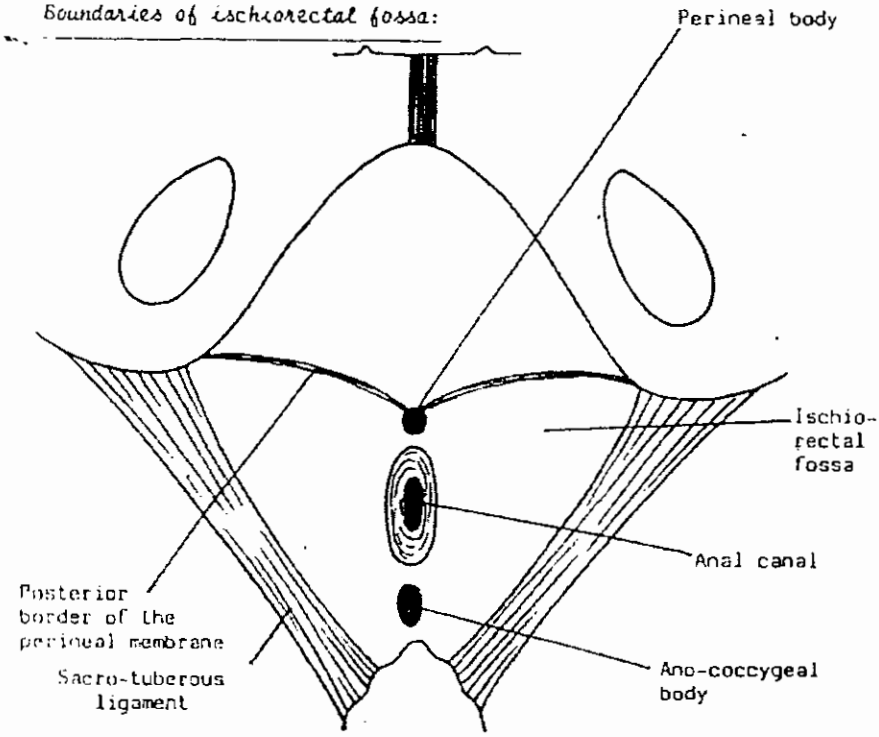
Divisions of the perineum

A transverse line joining the anterior parts of the ischial tuberosities & passing immediately anterior to the anus divides perineum into 2 triangular regions: a posterior anal △ & an anterior urogenital △

Anal triangle ⇒ Ischiorectal fossae



Boundaries of ischiorectal fossa:



Notice → the median part of the anal triangle is occupied by lower part of anal canal surrounded by its sphincters. The perineal body lies infront while the ano-coccygeal ligament lies behind the anal canal ⇒ The lateral parts of this region are occupied by ischio-rectal fossae

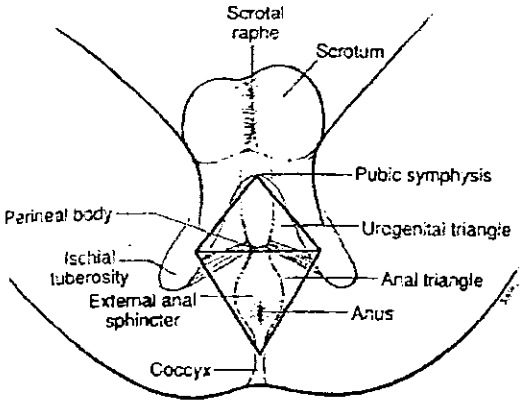


Figure 3-54. The diamond-shaped perineum, extending from the pubic symphysis to the coccyx. Note that a transverse line joining the anterior ends of the ischial tuberosities divides the perineum into two unequal triangular areas, the urogenital triangle anteriorly and the anal triangle posteriorly. The midpoint of the transverse line indicates the site of the perineal body (central perineal tendon).

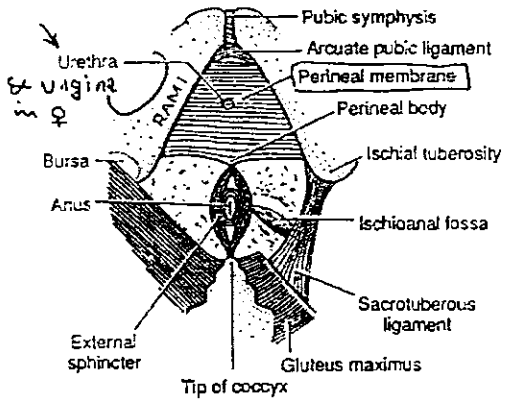


Figure 3-55. The boundaries of the perineum. Observe that the angles of the diamond-shaped region are at the arcuate pubic ligament, the tip of coccyx, and the ischial tuberosities.

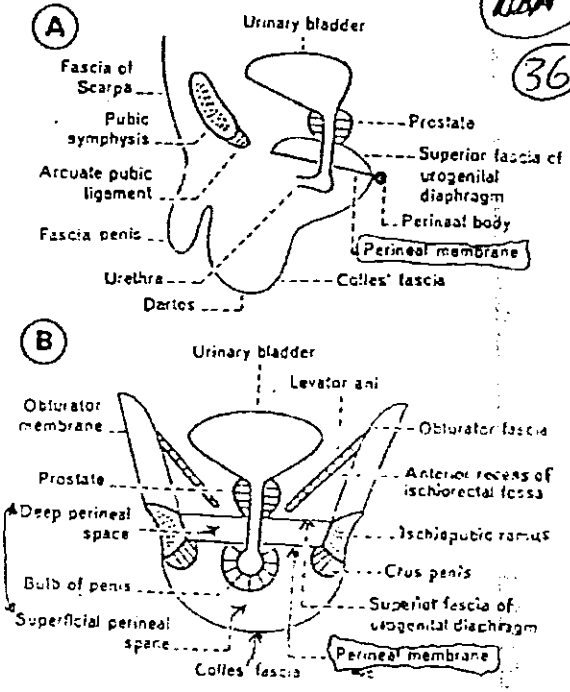
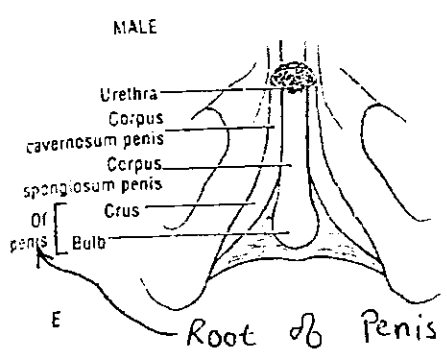


Fig. 299 Arrangement of the superficial and deep fasciae in the urogenital region in a male. (A) Sagittal section; and (B) coronal section.

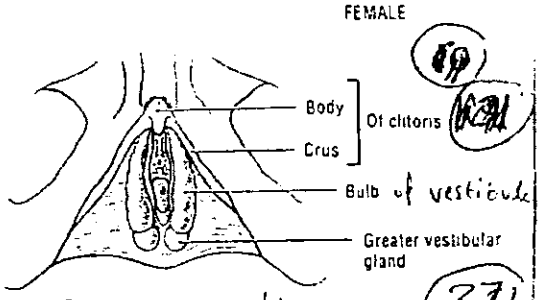
(*) Rupture of spongy urethra? extravasated urine spreads downwards deep to the membranous layer of superficial fascia, and fills first the superficial perineal space and then the scrotum, penis and lower part of anterior abdominal wall. It is prevented from going to the ischiorectal fossa or the thigh by the firm attachment of the membranous fascia to their boundaries (p. 261).

UROGENITAL REGION (triangle)

- It is the space lying between the sides of the pubic arch.
- It is filled with muscles and fascia forming the **urogenital diaphragm.**
- The fascia covering the inferior surface of the urogenital diaphragm is called the **perineal membrane (inferior fascia of urogenital diaphragm).**
- The fascia covering its superior surface is called **superior fascia of urogenital diaphragm.**
- In the erect posture the perineal membrane is placed nearly horizontal having upper and lower surfaces.
- The perineal membrane divides the urogenital region into 2 pouches (or spaces) :
  1) **Superficial perineal pouch** : below the membrane.
  2) **Deep perineal pouch** : above the membrane. (towards the pelvic cavity).

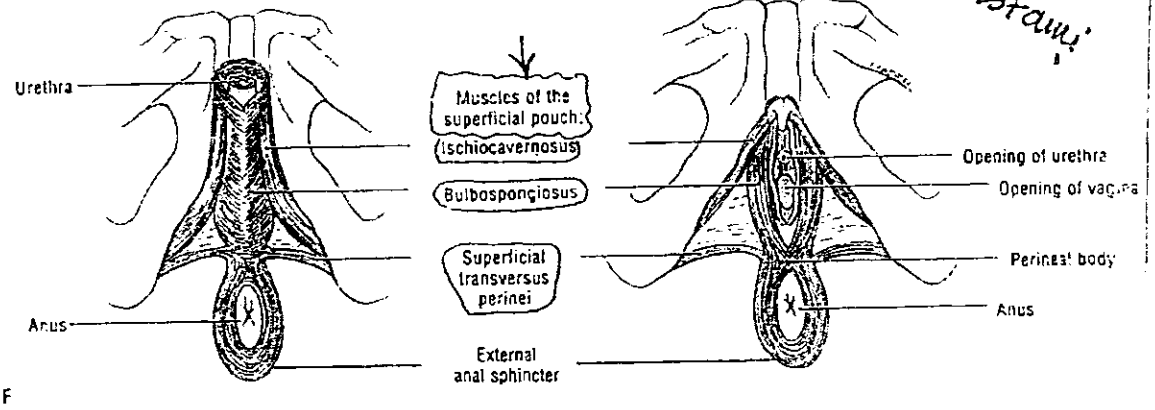


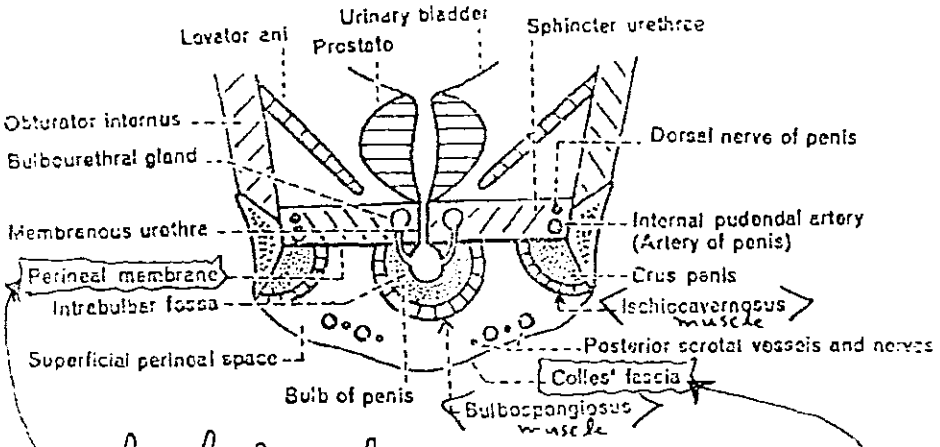
Root of Penis



Root of clitoris

Bustanu





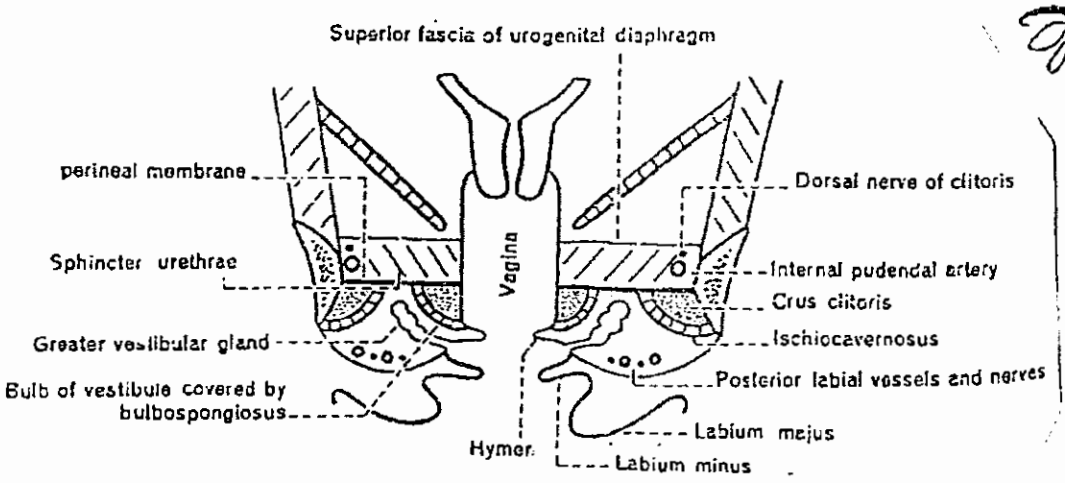
Coronal section in the urogenital triangle of a male

Superficial Perineal Pouch (space): is the space between the perineal membrane (inferior fascia of urogenital diaphragm) and the membranous layer of superficial fascia (Scarpa's fascia of anterior abdominal wall becomes Colles's fascia at perineum)

Boundaries
- Roof → perineal membrane
- floor → colles fascia
- Posteriorly → closed → roof is fused with floor
- Anteriorly → pouch is open → it is continuous with the space deep to the membranous layer of superficial fascia of the anterior abdominal wall i.e. Colles → Scarpa's
- on each side → roof & floor are attached to the sides of Pubic arch → ischio-pubic rami

Contents of the Superficial Perineal Pouch (space):

Remember that the perineal membrane is pierced in the male by the urethra and in the female by the urethra & vagina



Contents in the male → Root of Penis (2 crura & a bulb) & associated muscles

Crura of Penis → each crus lies close to the side of Pubic arch, it is the posterior part of the corpus cavernosum & is covered by a thin sheet of muscle termed the ischiocavernosus muscle

bulb of Penis → lies in the middle between 2 crura. It is the posterior part of the corpus spongiosum & is covered by a thin sheet of muscle termed the bulbo-spongiosus muscle. It is pierced by the urethra as well as by the ducts of the 2 bulbo-urethral glands (Cowper's glands) which lie in the deep perineal Pouch.

Contents in the female → Root of clitoris & associated muscles

Notice the clitoris < is devoid of urethra
it has 2 crura but its bulb is splitted by the Vagina into 2 parts → each → bulb of vestibule

Contents in ♂ & ♀

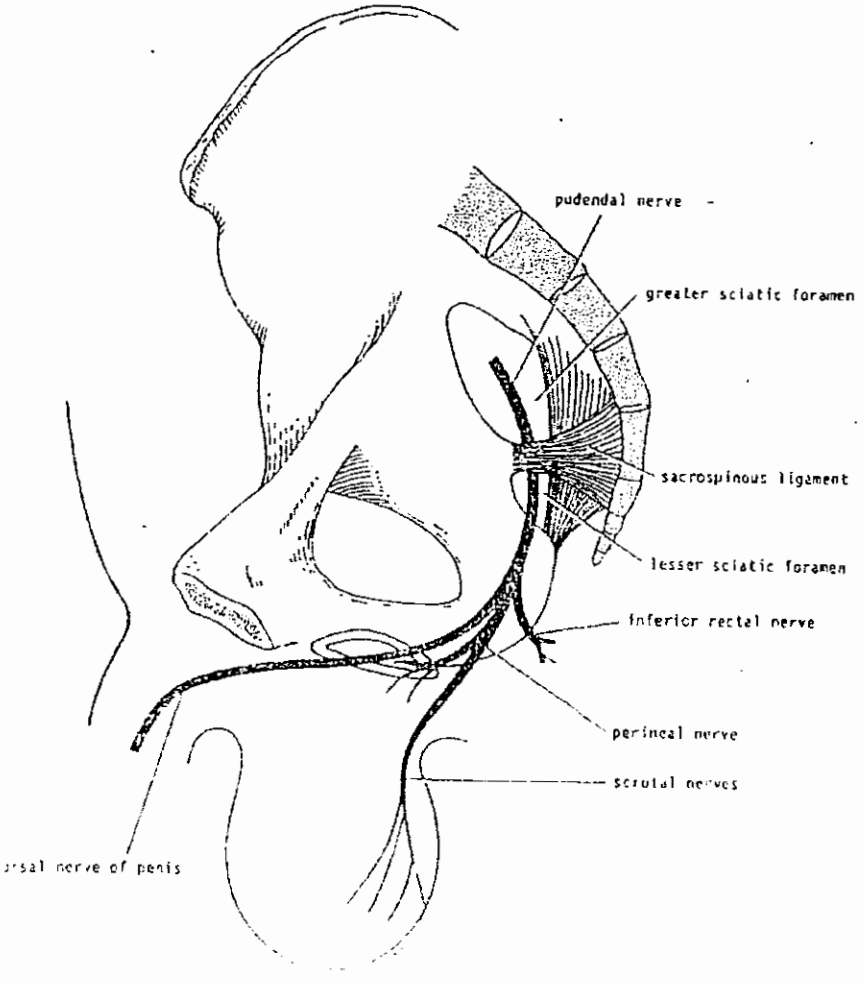
- {Scrotal nerves in ♂ : arise from the perineal branch of Pudendal nerve
  labial » » ♀
- {Scrotal or labial arteries : arise from the internal Pudendal artery
- {Terminal branches of internal Pudendal artery < Deep a. of Penis / dorsal « «

Deep Perineal Pouch (space)

- It is a closed space between the perineal membrane below & the superior fascia of urogenital diaphragm above
- It is limited on each side by sides of the pubic arch

Boundaries
- Roof : sup. fascia of Urogenital diaphragm
- floor : perineal membrane
- Anterior & Posterior borders : the roof fuses with the floor (closed)

Contents
1. Membranous part of Urethra surrounded by the Sphincter urethrae muscle (voluntary)
2. 2 bulbourethral glands (in ♂) → their ducts pierce the perineal membrane & open into spongy urethra
3. deep transverse perinei muscles
4. Dorsal nerve of penis (from Pudendal nerve)
5. Internal Pudendal vessels



Pudendal nerve

a branch of sacral plexus $S_{2,3,4}$
↓
leaves pelvis through greater sciatic foramen
↓
Crosses the back of the Sacrospinous ligament to enter the lesser sciatic foramen where the pudendal canal begins
↓
Passes through the pudendal canal in the lateral wall of ischiorectal fossa where it gives its terminal branches

- Perineal nerve: gives scrotal or labial branches as well as muscular branches to all Perineal muscles
- dorsal nerve of [illegible]

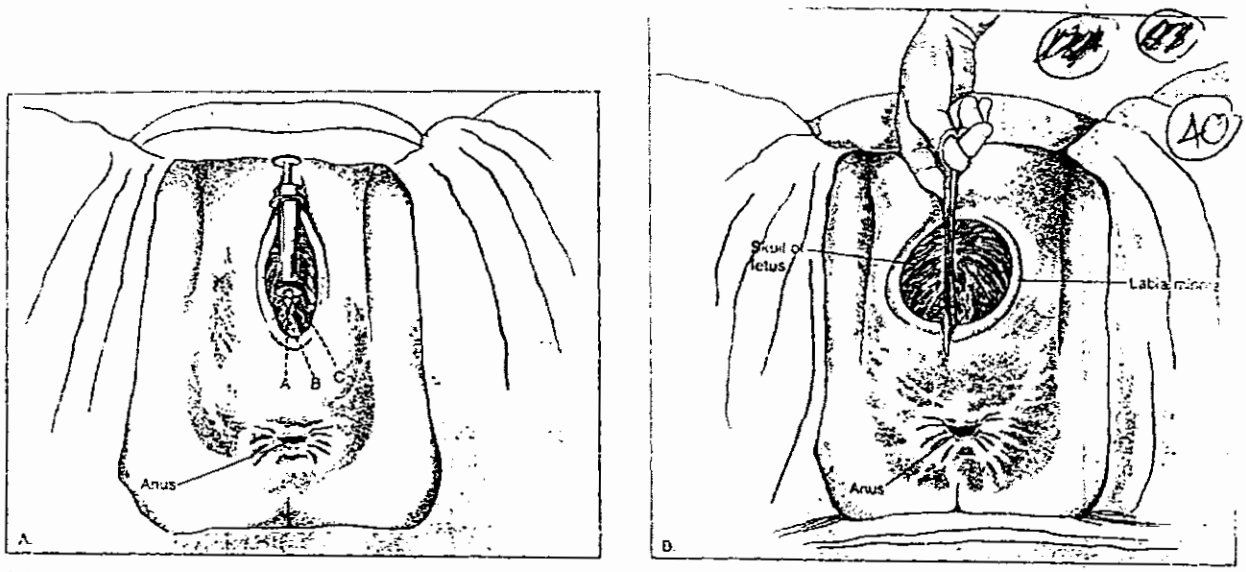


FIGURE 18–12. Part A shows injection sites for local anesthesia by perinal infiltration. A indicates median; B, mediolateral; and C, lateral episiotomy. Part B shows initial incision for a median episiotomy.

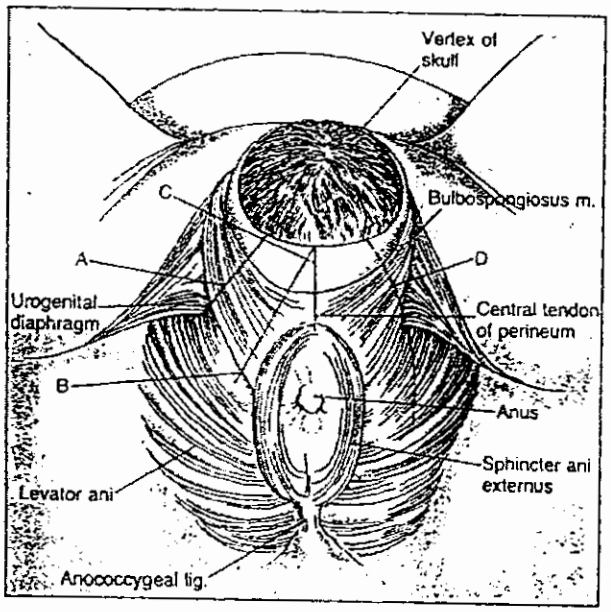


FIGURE 18–13. Various types of episiotomy and the muscles of the pelvic floor involved. A indicates lateral; B, mediolateral; C, median episiotomy; and D, the site of so-called SCHUCHARDT, or paravaginal incision.

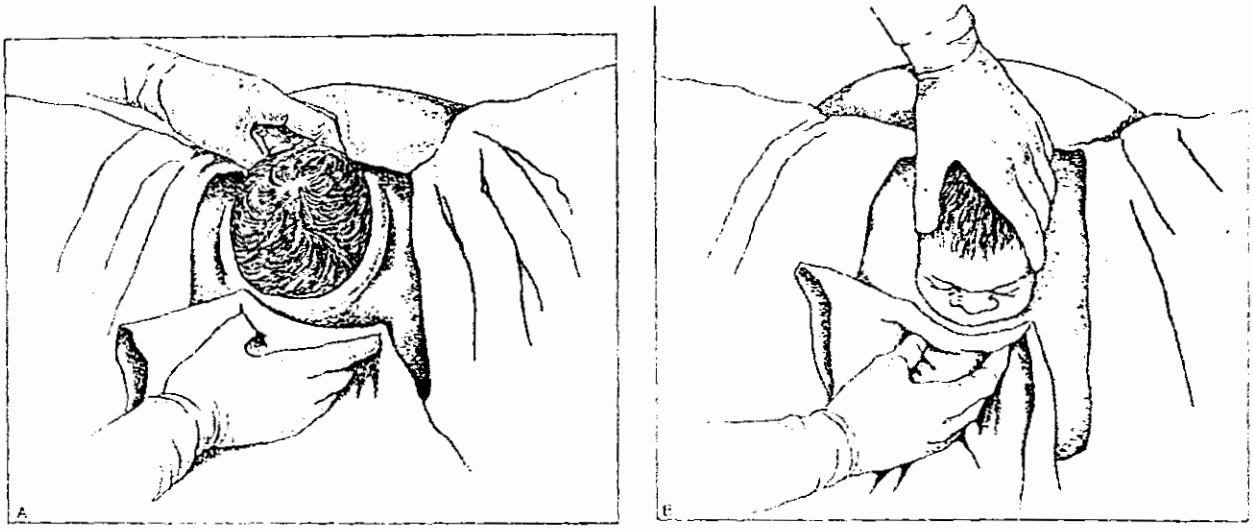
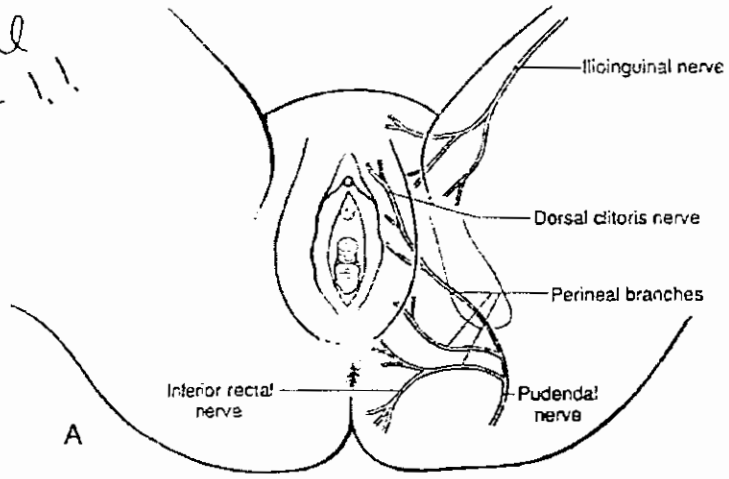


FIGURE 18–14. A, Birth of the head with vulva completely distended. B, Birth of head continues with mouth appearing over the perineum.

Pudendal block !!



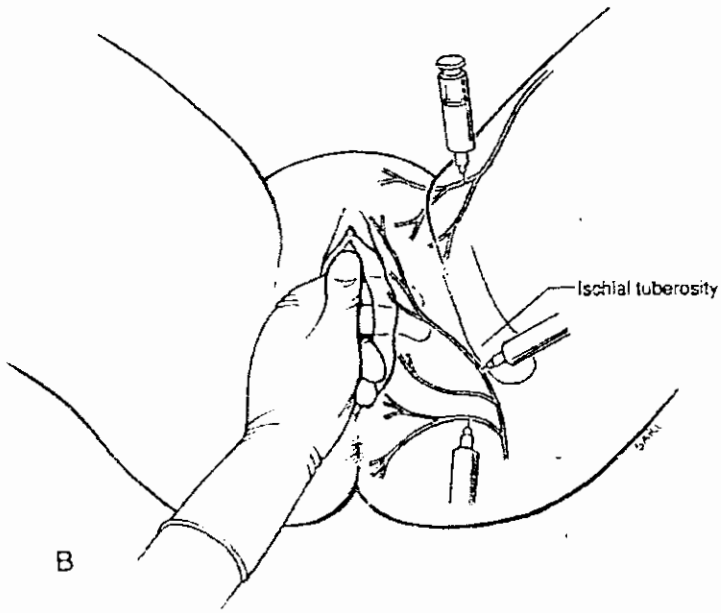
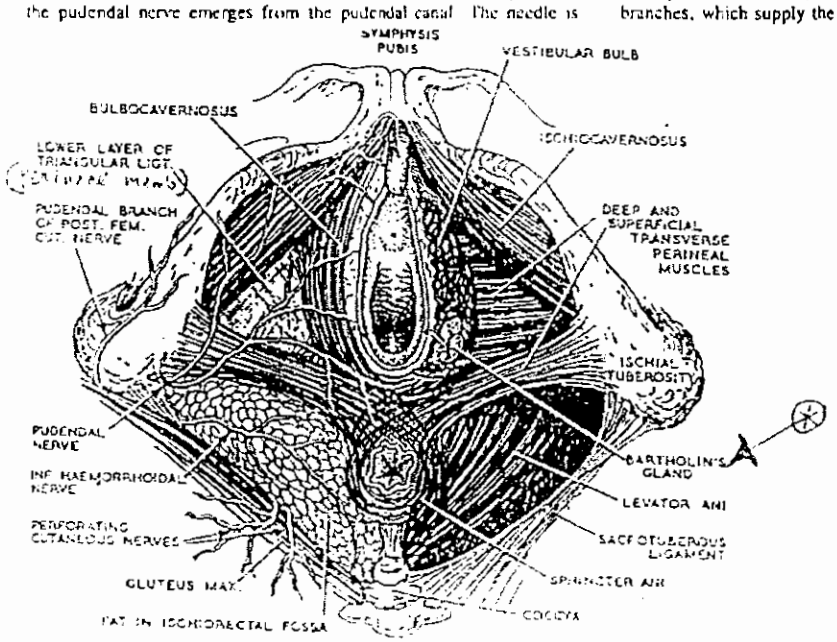


Figure 3-74. *A*, Distribution of the pudendal and ilioinguinal nerves to the female perineum. *B*, The pudendal nerves may be blocked with anesthetic. The needle is inserted toward the ischial tuberosity, where the pudendal nerve emerges from the pudendal canal. The needle is guided by the digits in the vagina until its tip is posterior and inferior to the ischial spine where the pudendal nerve lies. The injection from the upper needle blocks (anesthetizes) the ilioinguinal nerve and its labial branches, which supply the vulva (see Fig. 3-72).



The following structures are cut during mediolateral episiotomy: