

Practical class 4

REPRODUCTIVE SYSTEM

OBJECTIVES

By the time you have completed this practical, and any further necessary reading, you should be able to:

1. Appreciate the major anatomical features and the secondary sexual characteristics between the sexes.
2. Identify the individual organs of the male reproductive system and state the specific function of each.
3. Describe the structure of the penis and the mechanism by which it performs its role in erection and ejaculation.
4. Describe the vasculature, lymphatics and nerve supply to the male and female reproductive organs.
5. Appreciate the generalised role of the female reproductive system.
6. Identify the individual organs of the female reproductive system and state the specific function of each.
7. Trace the path followed by sperm cells from their site of origin to the exterior.
8. State the morphology of the breast and its development in pregnancy.
9. Identify the placenta and understand its role in the welfare of the developing embryo/foetus.

Background reading

Rogers: Chapter 44; The female reproductive tract and breast
45; The male reproductive tract

INTRODUCTION

Sexual activity is a basic drive that is necessitated by the need to reproduce for the survival of the species. In humans, the reproductive organs are formed in the embryonic/fetal stage, they do not develop to a functional maturity until puberty when intercourse may be successful in producing offspring. In women, a finely tuned timing mechanism controls the major physical modifications associated with reproduction as is evident in the processes of menstruation, conception, pregnancy, childbirth and lactation of the infant.

Basically the reproductive organs are grouped into 3 categories:

- 1) the external genitalia,
- 2) the gonads, where gametes or sex cells are produced, also the site for the production of important sex hormones,
- 3) the tube system for conveying the sperm and ovum enabling them to unite with resultant zygote being implanted, and finally
- 4) the accessory glands which support the gametes and lubricate the copulatory organs.

Throughout this class it is essential to appreciate the homology of structures between the male and female and to be aware of similarities and differences between the sexes.

At this point revise the bony pelvis and the pelvic diaphragm covered in the previous class.

INGUINAL CANAL

In the male the gonads are located outside of the abdominopelvic cavity, but remain intimately connected to the structures located there.

What purpose does this serve?

For this to be possible the testes have migrated out of the cavity and through the anterior abdominal wall during development. This creates a structure called the **inguinal canal**. Study this on the prosections.

What layers of muscle and fasciae contribute to the inguinal canal?

This canal then carries a group of structures known collectively as the **spermatic cord**.

Complete the list below of these structures.

Ductus (Vas) Deferens

External genitalia

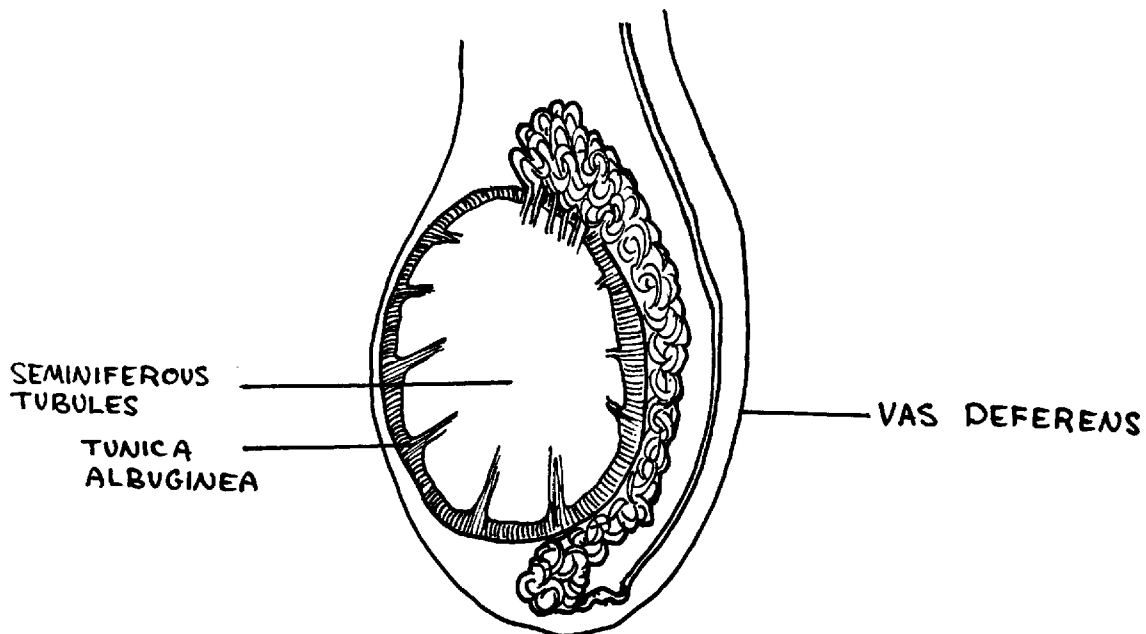
MALE

The gonads consist of **seminiferous tubules** embedded in connective tissue (**tunica albuginea**). From these extends the **epididymis**.

On a sectioned of scrotum identify the following:-

Head, body and tail of the **epididymis**

Label these on following diagram.



On a male cadaver, identify the **body, glans, prepuce, frenulum,** and **meatalorifice** of the penis.

Now look at the body of a sectioned penis and Identify:-

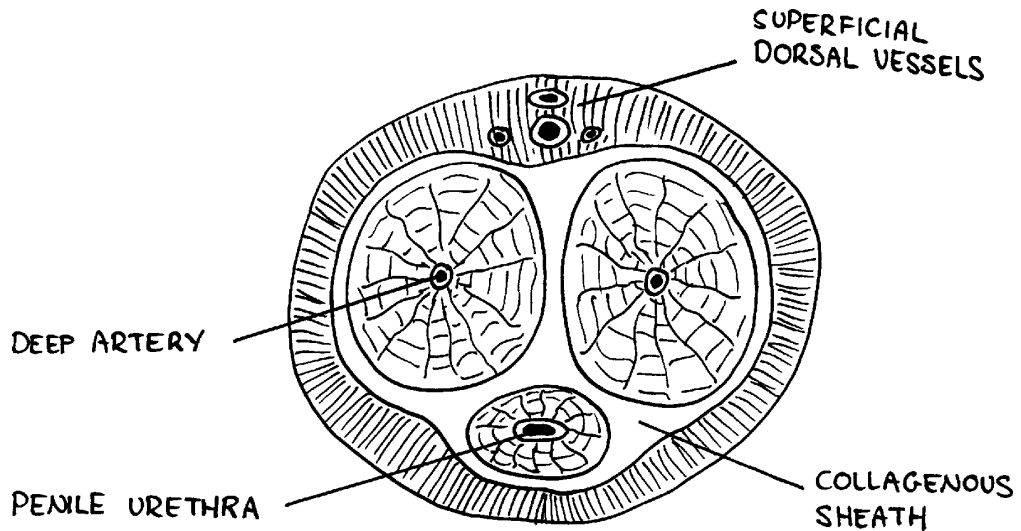
Corpora cavernosa

Corpus spongiosum

Urethra

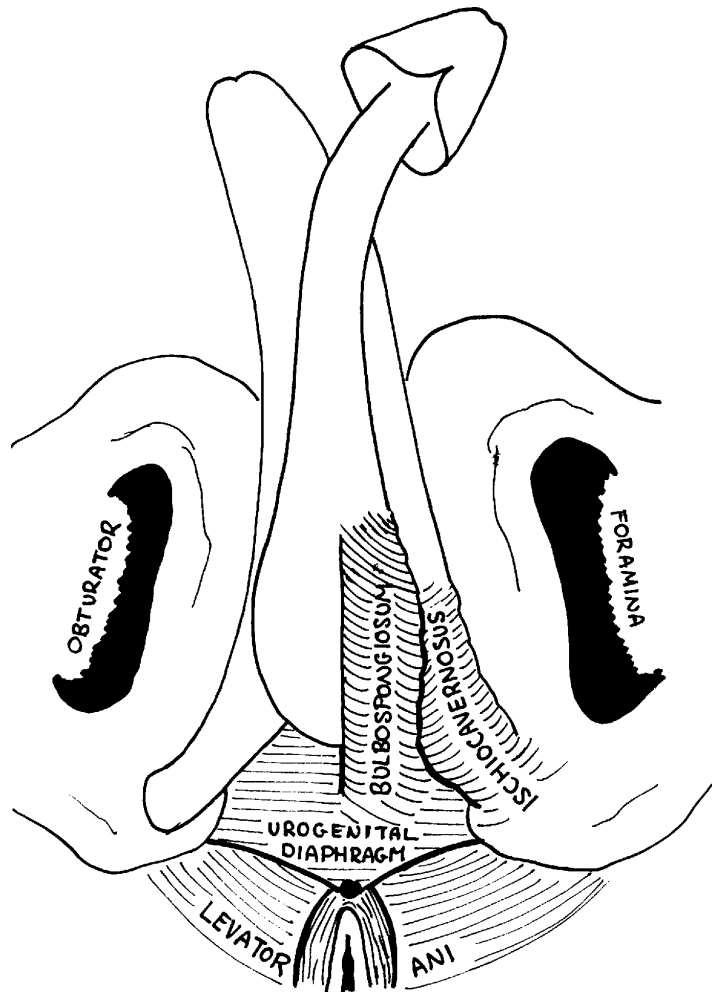
Deep and superficial vessels

Label the erectile tissues on the following diagram of the cross section of the penis.



The root of the penis is firmly attached to the pelvis and urogenital diaphragm by muscles which attach to the **bulb** of the **corpus spongiosum** and the **crus** of the **corpora cavernosa**.

Label these on the following diagram.



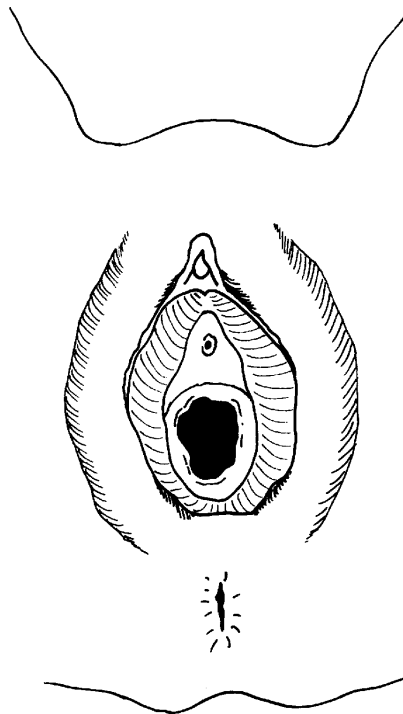
Trace backwards the urethra from the **fossa navicularis** along the **penile urethra**. Be aware that the root of the penis receives ducts from the paired **urethral glands**. The urethra then takes a sharp bend upwards into the **deep perineal pouch** where it is called the **membranous urethra**.

FEMALE

On a female cadaver, identify the following structures:-

Mons pubis, labia minora and majora with prepuce and frenulum of clitoris
Vestibule of vagina, vaginal orifice, hymenal remnants
Urethral orifice

Label these where possible on the following diagram.



Consider the parallels between the external genitalia of the male and female, and complete the table below.

Male	Female homologue
Scrotum	
Corpus spongiosum	
Prepuce	
Corpora cavernosa	

INTERNAL REPRODUCTIVE STRUCTURES IN THE PELVIS

Male

VAS DEFERENS

This is a muscular tube which arises from the tail of the **epididymis**, traverses the **inguinal canal** and emerges into the abdominopelvic cavity at the **deep inguinal ring**.

On suitable prosections find the position of the deep inguinal ring and trace the course of the **vas deferens** from it to the supero-lateral angles of the bladder.

SEMINAL VESICLES

These paired structures are located on either side of the posterior surface of the bladder, note their relation to the ureter, the vas deferens and the prostate gland. Observe the junction of its duct with the **ampulla** of the vas deferens to form the **ejaculatory duct** which empties into the prostatic urethra.

What secretions do the seminal vesicles produce?

PROSTATE GLAND

The prostate gland is fused to the inferior part of the bladder and it surrounds the prostatic urethra. Look at the specimen where the prostate has been incised and the urethra has been opened anteriorly to show the posterior luminal surface of the urethra.

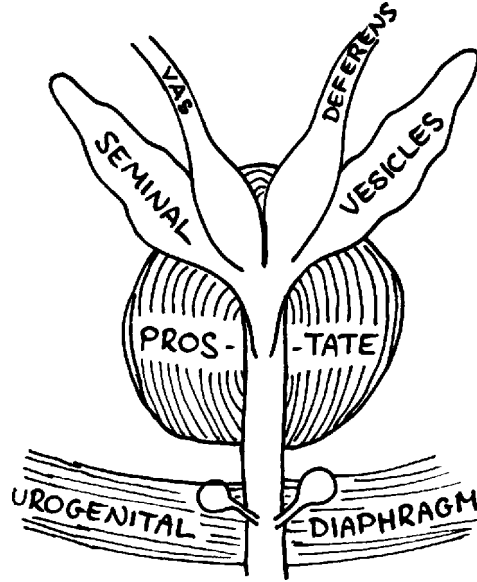
What secretions does the prostate gland produce?

The **ejaculatory ducts** divide the prostate, although not completely, into 3 lobes - the left, right and the median lobe. The latter has considerable clinical importance because of its anatomical relation with the bladder and its tendency to enlarge in benign senile hypertrophy of the prostate.

How might an enlarged prostate be approached without opening the peritoneal cavity?

Consider the diagram below of the male accessory reproductive glands. Label the following structures:

Ejaculatory duct
Ampulla



BULBOURETHRAL (COWPER'S) GLANDS

These are small, paired structures located in the **urogenital diaphragm** which empty into the **membranous urethra**.

What secretions do these glands produce?

Complete the table to indicate what secretions contribute to the final ejaculated semen?

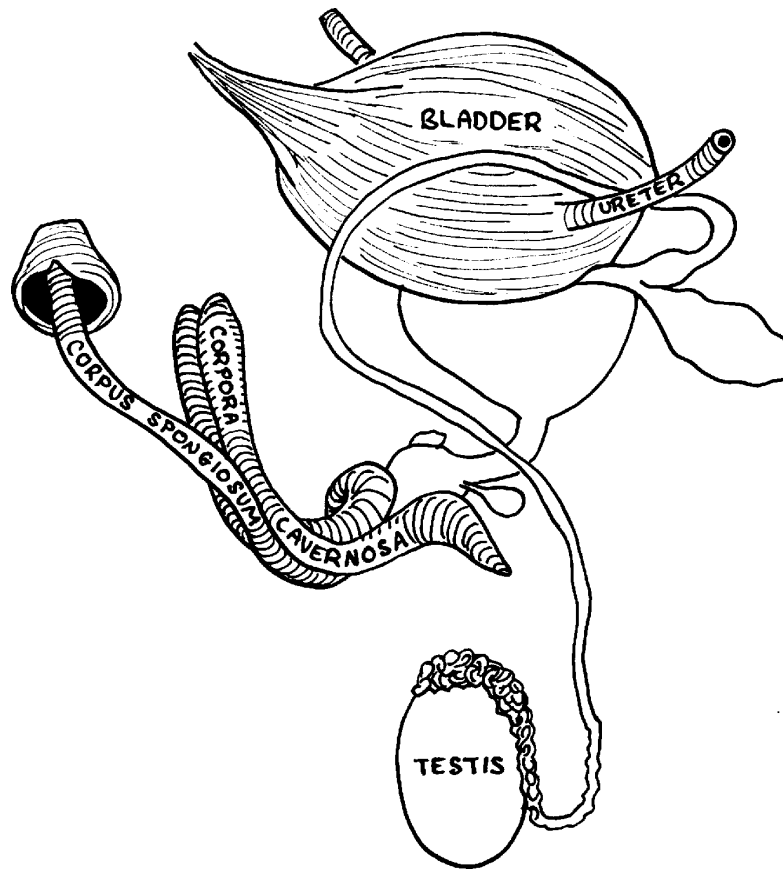
Spermatozoa

Consider the following diagram, and label:

Accessory reproductive glands

Vas deferens

Membranous urethra.



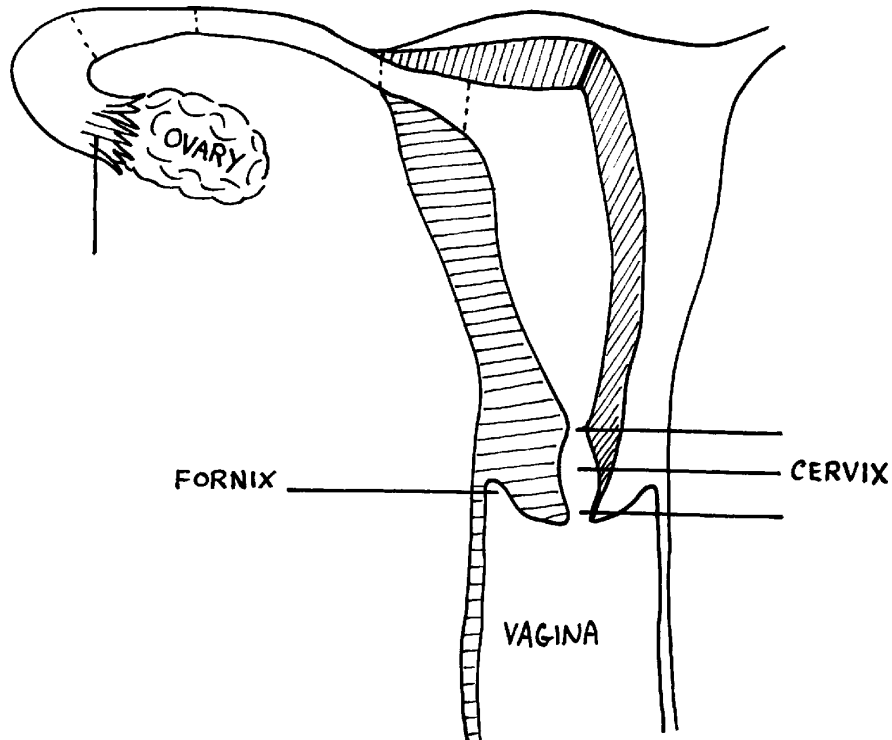
Female

In the female the duct system for the transference of gametes is short, and leads to the uterus which is the site of implantation and development for the zygote. This then communicates with the exterior via the birth canal.

What three structures constitute the birth canal?

UTERUS

Complete the labelling of the diagram below, and label the four parts of the uterine (fallopian)



tube indicated.

You should appreciate that in the female, the abdominopelvic cavity is not closed as it is in the male, rather there exists a route for potential infection via the birth canal and fallopian tubes at the incomplete union between the ovary and the ostium of the tube.

Also note that this provides one route for ectopic pregnancies.

What does the term 'ectopic' mean?

Where does fertilisation normally take place?

On available prosections and museum specimens identify the following:-

Fallopian (uterine) tubes

Fundus

Body

Cervix (internal and external os).

Define the terms '**nulliparous**' and '**multiparous**'.

The normal position of the uterus is '**anteflexed**' and '**anteverted**'.

With simple line drawings illustrate the meanings of these terms.

Look through a few specimens of female pelvis and check if any of them show a retroverted or retroflexed uterus.

On a suitable prosection study the peritoneal relations of the internal female structures, and locate the **rectovesicular** and **uterovesicular** peritoneal spaces.

The uterus and cervix are firmly anchored in position in the pelvis by a number of ligamentous attachments.

Identify and establish the attachments of the following ligaments:-

	Attachments
Broad ligament	
Ovarian ligament	
Round ligament	

Observe the uterine (or fallopian) tubes noting its **mesosalpinx** part, curvatures, fimbriated end and abdominal **ostium**.

OVARY

Locate the ovaries in the lateral walls of the pelvis and the ovarian fossa around them. Note that repeated pregnancies may have displaced the position of the ovary and after menopause they become atrophied and fibrous.

What proportion of the original ova are ovulated in the normal life span of a woman?

BLOOD VESSELS, LYMPHATICS & NERVE SUPPLY TO THE REPRODUCTIVE ORGANS

Arteries

The blood supply to the gonads and genitalia is via two major branches from the aorta, the **gonadal** and **internal iliac** arteries.

GONADAL ARTERY

These are paired lateral branches of the abdominal aorta.

At what vertebral level do they originate?

In the male, they descend to enter the inguinal canal at the deep inguinal ring, where they become the **testicular** artery and contribute to the **spermatic cord**.

In the female the **ovarian** artery descends with the **suspensory ligament** to supply the ovaries via the **broad ligament**. Note that this vessel freely anastomoses with the **uterine** artery, and may in fact be replaced by it.

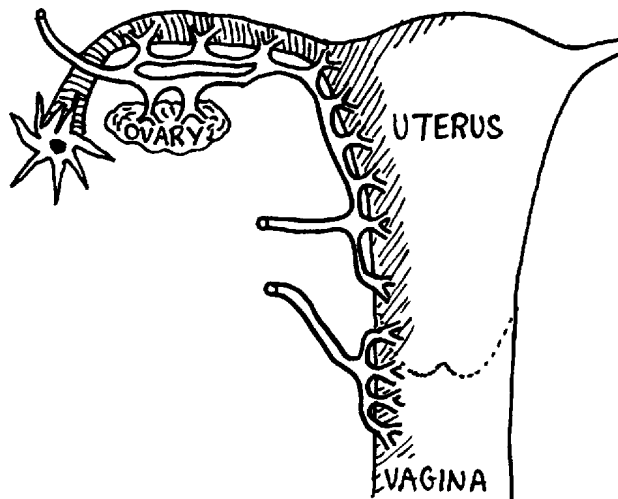
INTERNAL ILIAC ARTERY

This is a branch of the **common iliac** artery which is in turn the terminal bifurcation of the **abdominal aorta**, and supplies the reproductive tract.

The uterine and vaginal arteries branches from the anterior division of the internal iliac and supply the uterus and vagina.

What equivalent structures are supplied by this vessels homologue in the male?

Label the arterial supply to the female reproductive tract in the following diagram.

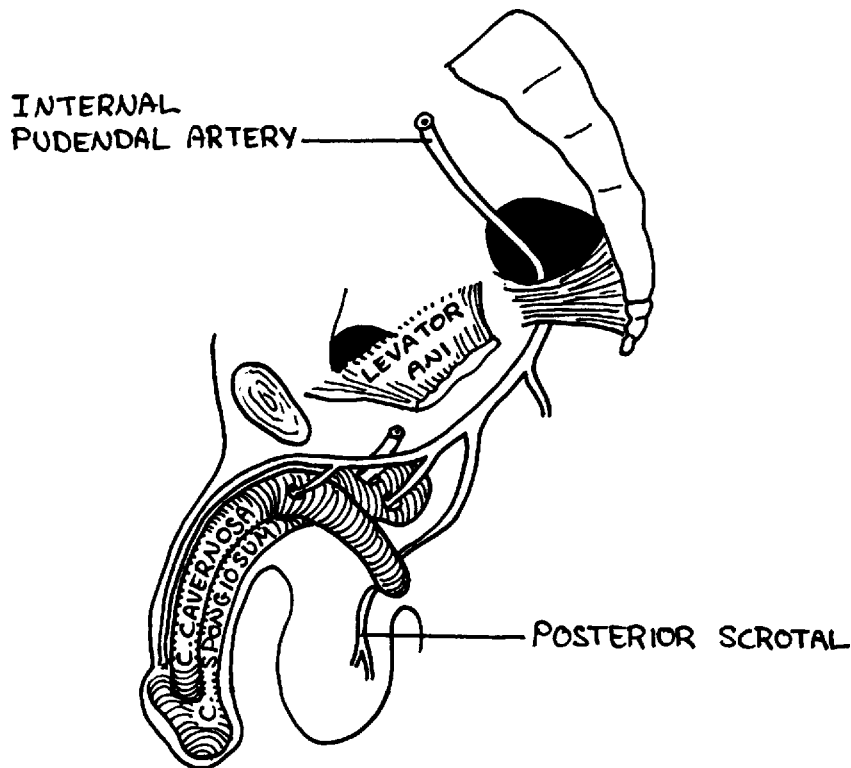


The other important branch of the anterior division of the **internal iliac** artery is the **pudendal artery**. This gives rise to the **deep artery**, the **dorsal artery**, and the **artery of the bulb of the penis**.

What equivalent structures are supplied by these vessels homologue in the female?

On a suitable prosection trace the course of the **pudendal artery** through the **greater sciatic foramen** and between the **piriformis** and **coccygeus** muscles. As it enters the perineum through the **lesser sciatic foramen** it is accompanied by the pudendal nerve both passing in the **pudendal canal**. Note that it travels in the perineum, that is below the pelvic floor for part of its course.

Label the terminal branches of the male pudendal artery in the following diagram.



Veins

PROSTATIC PLEXUS

A venous plexus surrounds the prostate and lower urinary bladder. This plexus is the **plexus of Santorini** or **prostatic plexus** which communicates posteriorly and constitutes an important route for metastasis of prostatic cancer.

PAMPINIFORM PLEXUS

Surrounding the **vas deferens** you will find a collection of small veins which constitute the **pampiniform plexus**, these unite to form the **testicular vein** at the deep inguinal ring.

What is the function of this arrangement?

TESTICULAR/OVARIAN VEINS

Observe these veins in suitable prosections. In a male specimen you will find that the **right testicular** vein drains into the **inferior vena cava** and the left into the **left renal** vein.

LYMPHATICS OF THE REPRODUCTIVE TRACT

Lymphatic drainage of the internal organs largely follows the arterial supply and venous drainage by passing backwards through the nodes around the branches of the iliac arteries and abdominal aorta.

Lymph from the scrotum and penile skin or labia and the distal part of the vagina drain into the **superficial inguinal** nodes.

NERVE SUPPLY TO THE REPRODUCTIVE ORGANS

This can be broadly divided into somatic and autonomic components.

Somatic component

The **ilioinguinal nerve** originates from L1 and enters the inguinal canal at the **superficial inguinal ring** to supply skin at the root of the penis in the male and the labia in the female.

The **genitofemoral** nerve originates at L1-2 and enters at the **deep inguinal ring**.

What structure(s) in the male are supplied by the genital branch of the genito-femoral nerve?

What is the clinical significance of this nerve?

The **pudendal** nerve arises from the sacral plexus and follows the course of the pudendal artery to innervate the **bulbospongiosus** and **ischiocavernosus** muscle.

From what segmental level does the pudendal nerve arise?

Autonomic component

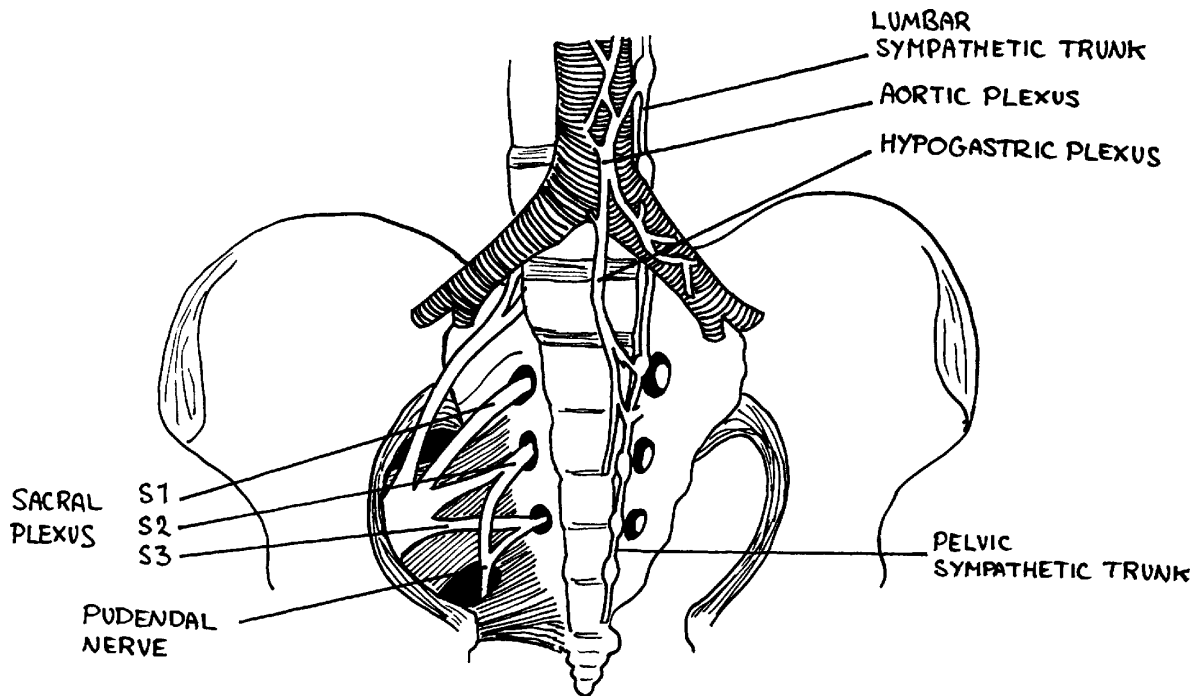
Sympathetic fibres from L1, L2 via the **hypogastric plexus** supply; vas deferens, seminal vesicles, prostate and epididymis in the male .

Sympathetic nerve fibres from pelvic and **ovarian plexuses** and parasympathetic nerve fibres from the pelvic splanchnic nerves supply the female genital tract.

Parasympathetic fibres from S2, S3, S4 again via the **hypogastric plexus** innervate erectile tissues in both male and female.

What are these erectile structures?

In the following diagram the major parasympathetic and somatic nerve branches are shown on the left, while the major sympathetic structures are shown on the right.



Study this carefully, and attempt to locate the structures on the cadavers.

ACCESSORY ORGANS

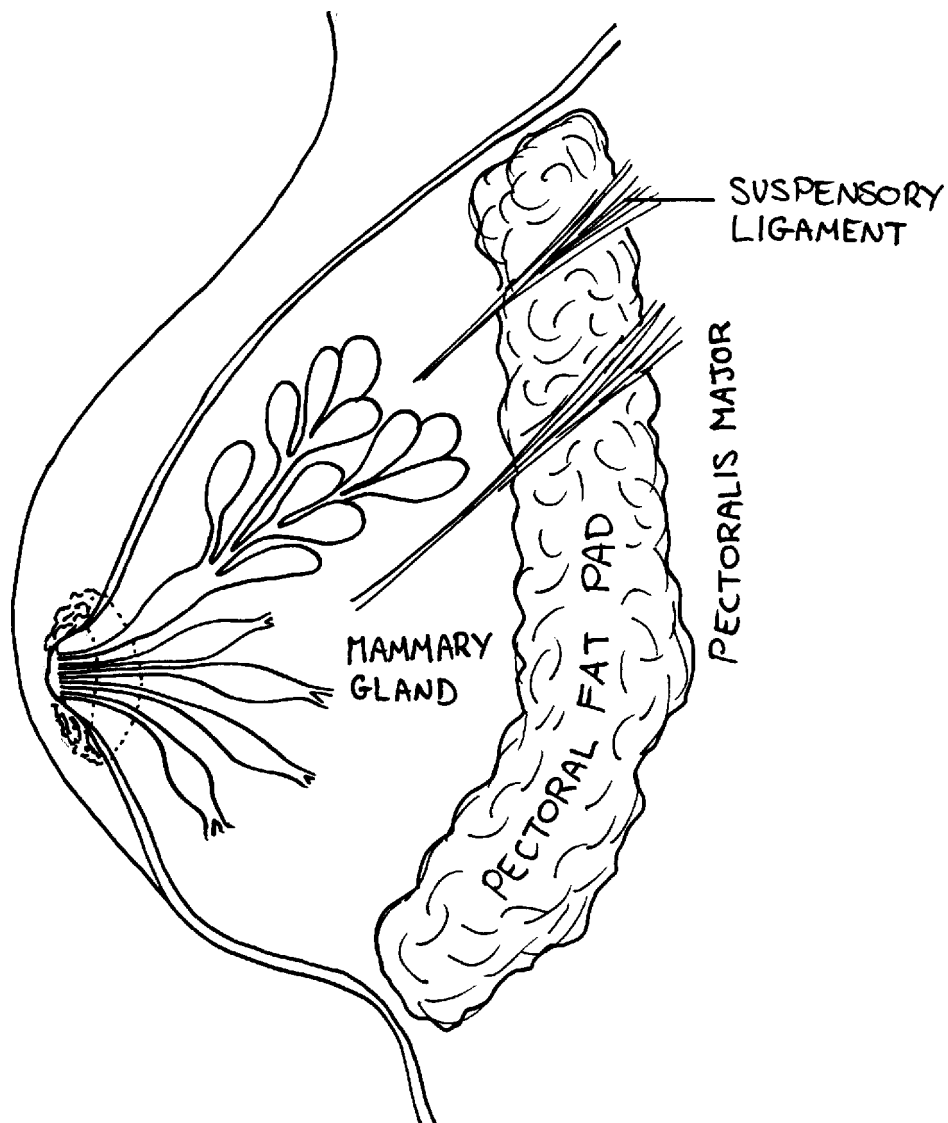
In the female two additional structures should be considered at this time. Both are important during pregnancy and serve to supply nutrition prior and immediately subsequent to birth.

Breast

The shape of the breast and the position of the nipples is variable and depends on the build, age and state of pregnancy etc. its size is determined largely by the amount of adipose tissue present.

On following diagram label:

- Lactiferous duct**
- Lactiferous sinus**
- Nipple**
- Areolae**



Placenta and umbilical cord

Look at the museum specimens of the placenta and note that one surface of the disc shaped structure is rough and spongy - the maternal side and the other side (the foetal side) is smooth and bears the attachment of the umbilical cord.

List four functions of the placenta.

- 1.
- 2.
- 3.
- 4.

Look carefully at the cut-end of the umbilical cord, you should be able to see at least three structures, these are the two **umbilical arteries** and single **umbilical vein**.

Complete the table to indicate with what structures these vessels communicate in the developing fetus.

Structures in cord	Fetal connection
Umbilical arteries	
Umbilical vein	Liver at porta hepatis
Urachus	

Return to the objectives at the beginning of the section, and ensure that you can address them.

