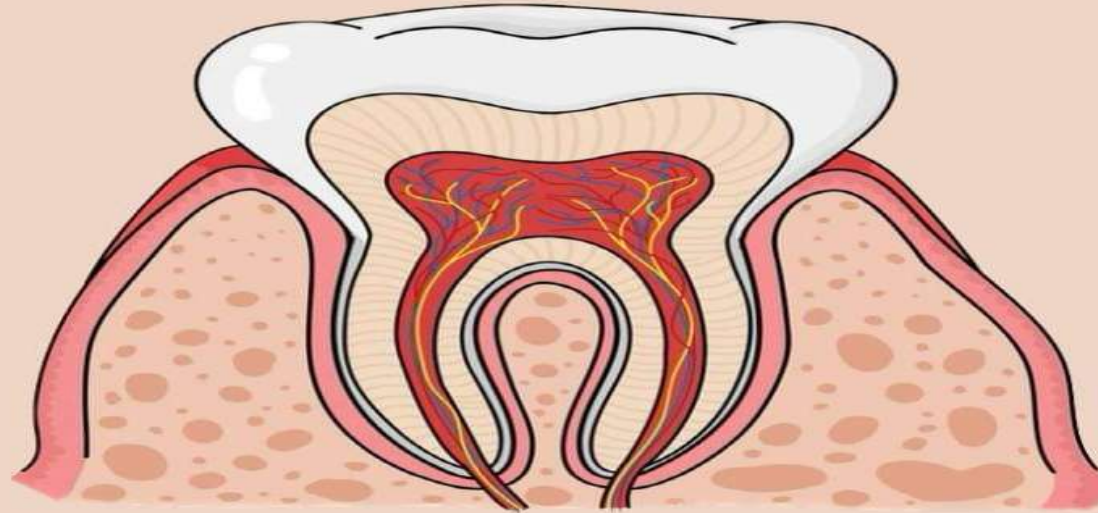




ANATOMY



LEC NO. : 23
DONE BY : Nour Al-amoush.

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

URINARY & LYMPHATIC & ENDOCRINE SYSTEMS

URINARY SYSTEM

wastes
ذاته مخرج كل
عنا نقصون بهل إعانة امتصاص

جهاز إخراجي

→ The urinary system is the (most important) excretory system of the body as it plays a vital role in maintaining homeostasis of water and electrolyte concentrations within the body.

مثل Na^+, K^+, Ca^{+2}

لوزادت اذ قلت
يج تحمل مشاكل مثل
نقص Ca^{+2} بسبب صفا شاة
العظام أو تشنجات

Components of the Urinary System: The urinary system includes following structures:

(physiology)
ببساطة تذكر ايلي أخذناه

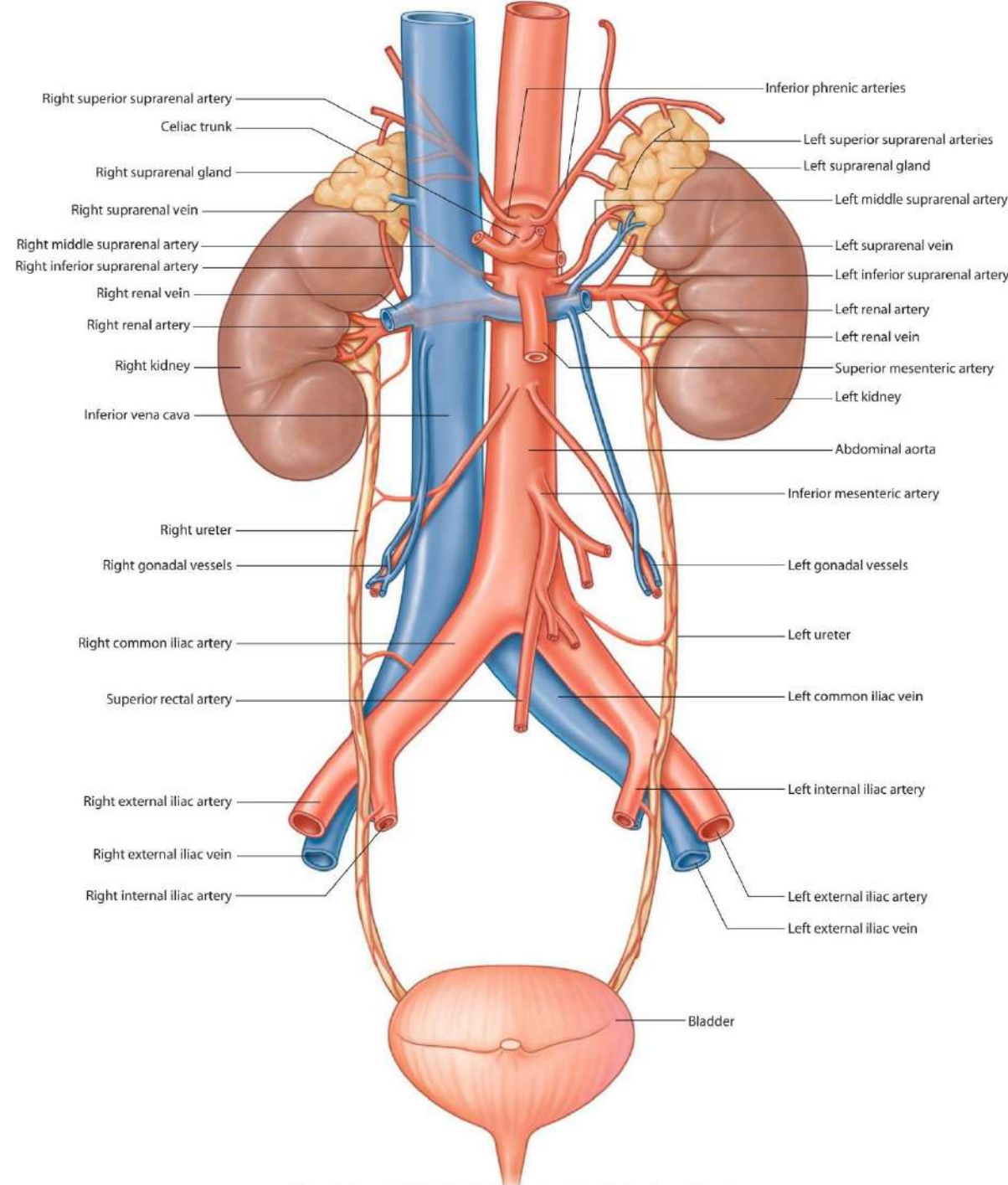
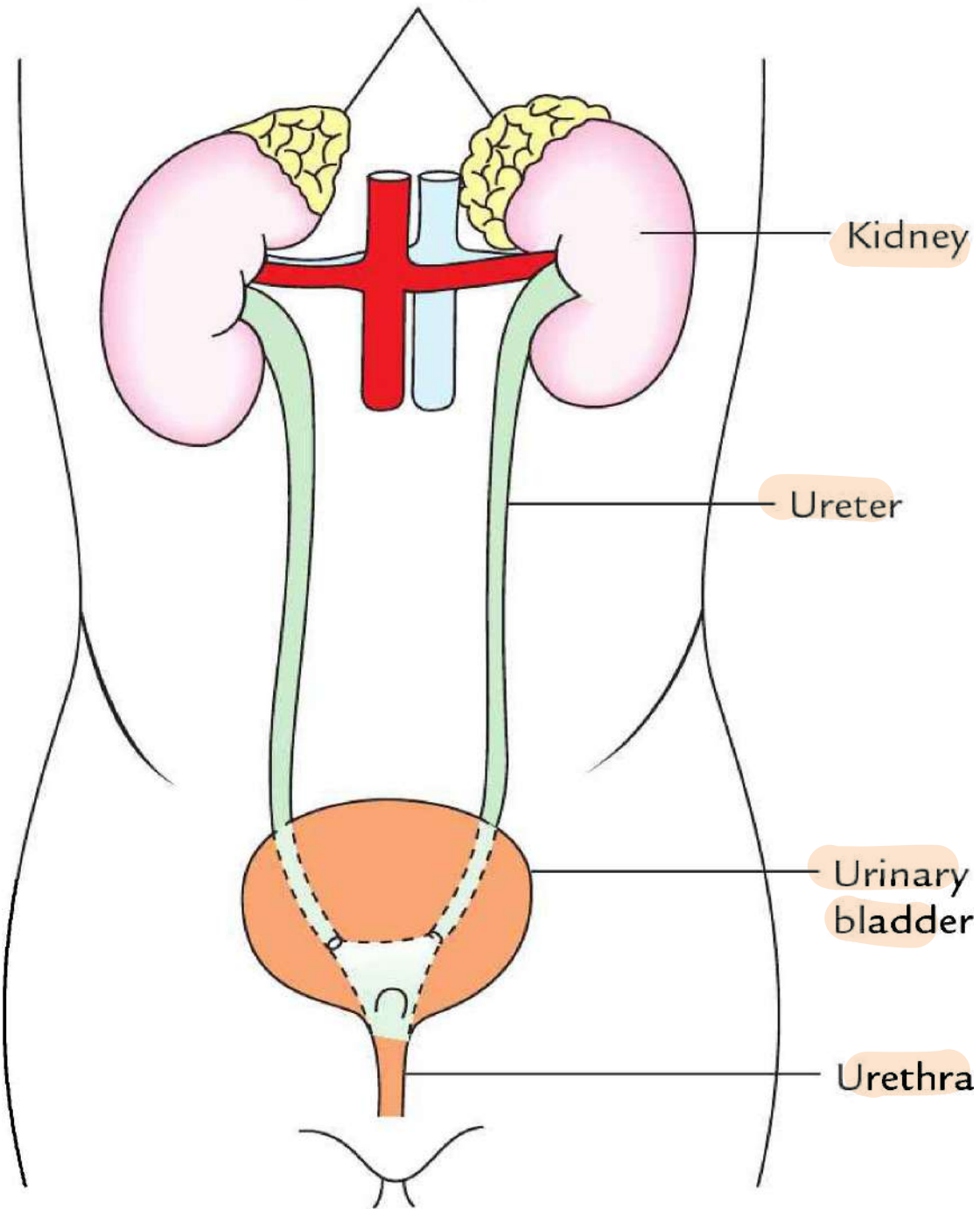
1. **Kidneys, paired** (2)
2. **Ureters, paired** (2)
3. **Urinary bladder, unpaired** (1)
4. **Urethra, unpaired** (1)

► The **kidneys** secrete **urine**, **ureters** convey **urine** from **kidneys** to the **urinary bladder**, the **urinary bladder** **collects** and **stores** urine and **urethra** **discharges** urine from urinary bladder to the **exterior**. (Anus)

Functions of the Urinary System

1. **Formation and secretion** of urine.
 → urea
 → electrolytes
 → waste products
2. **Maintenance of water and electrolyte balance** to establish the internal environment of body cells.
3. **Excretion of toxic metabolic products** such as **urea** and **creatinine**.
4. **Removal of various drugs** that have been taken into the body.

Suprarenal glands



Vasculature relating to kidneys, suprarenal glands, and ureters

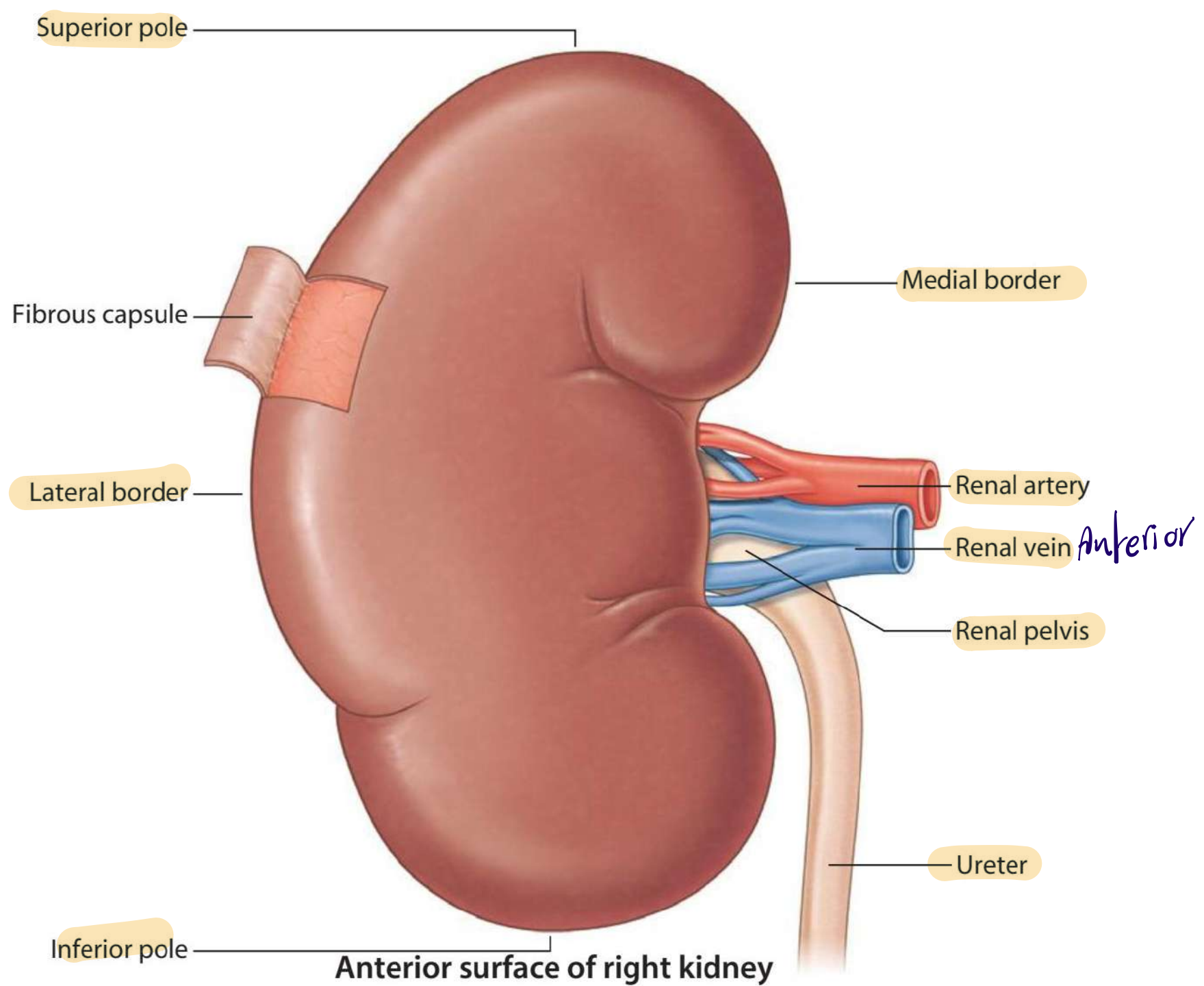
URINARY SYSTEM

Kidneys they are in posterior abdominal wall.

- Kidneys are the major excretory organs of the body and remove most waste products of the body, many of which are toxic.
- They are reddish brown ^{مثل الفاصوليا} bean-shaped organs measuring ^{طول} 10 cm X ^{عرض} 6 cm X ^{سُمك} 3 cm. → ^{الأرقام من حفظ}
- They lie retroperitoneally in the lumbar region.
- In the supine position, the kidneys extend from approximately T12 to L3.
- The right kidney is slightly lower than the left kidney because of the large size of the right lobe of the liver. ^{مسافة بسيطة طبياً}

Each kidneys has:

- Convex ^{poles} upper & lower ends. The Suprarenal gland related to the upper end. ^{superior}
- Convex lateral border.
- Concave medial border that shows a vertical slit called the hilum.
- The hilum transmits, from anterior to posterior, the renal vein, renal artery & the renal pelvis (VAP).

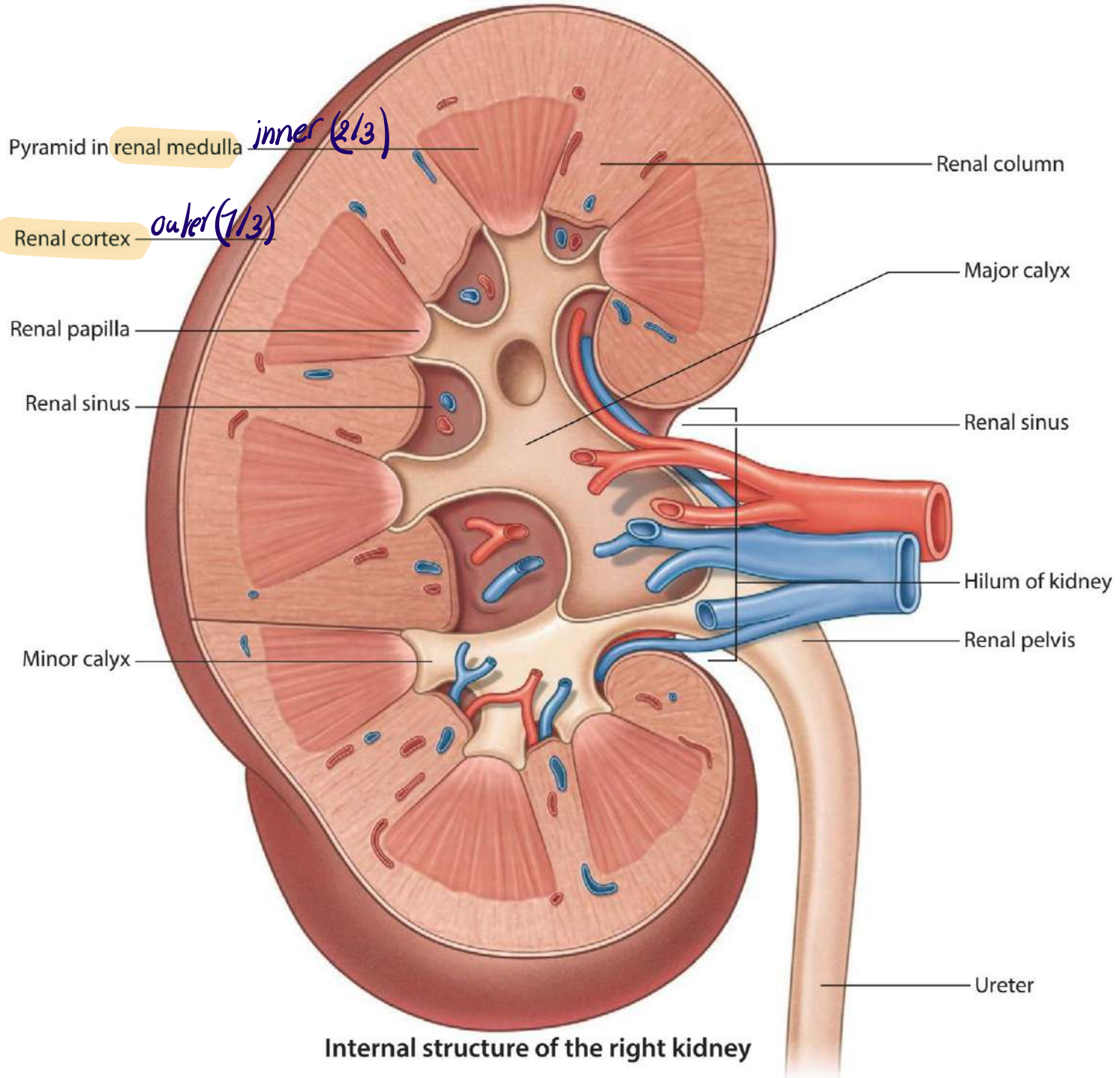


بشوفه بعين

Macroscopic Structure of Kidney

The naked eye examination of coronal section of kidney presents following features:

- The **inner two-third** of the cut surface of a kidney is occupied by **darkly stained pyramidal-shaped areas called pyramids** (8-15 in number). The tips of pyramids called **papillae** project into the **minor calyces**.
medulla
Apex
- The **outer one-third** of the cut surface of a kidney, i.e. the part lying external to the bases of the pyramids is called **cortex**.
- **The renal columns** similar to cortical tissue extend between the pyramids. The renal columns and pyramids constitute the medulla.
- The **minor calyces** surround the **renal papillae**. These minor calyces from several pyramids joined together to form **two or three major calyces**. → *from minor calyces*
- The **major calyces converge** to form a **funnel-shaped channel called renal pelvis** → *برايه تلتون*
ureter
- The **renal pelvis** then **narrows** to form a narrow tube, the **ureter**, which leaves the kidney and connects it to the urinary bladder.



Internal structure of the right kidney

URINARY SYSTEM

Ureters

صفت

Contraction رخصيص
urine نقل ↑

- Each ureter is a **25 cm (10 in.) long narrow muscular tube** which connects the **renal pelvis** with the **urinary bladder**.
- The **renal pelvis** is the **upper funnel-shaped portion** of the **ureter within kidney**.
- The ureter conducts **urine** from **renal pelvis** to the **urinary bladder** by **peristaltic contraction** of smooth muscle in its wall.

هوا

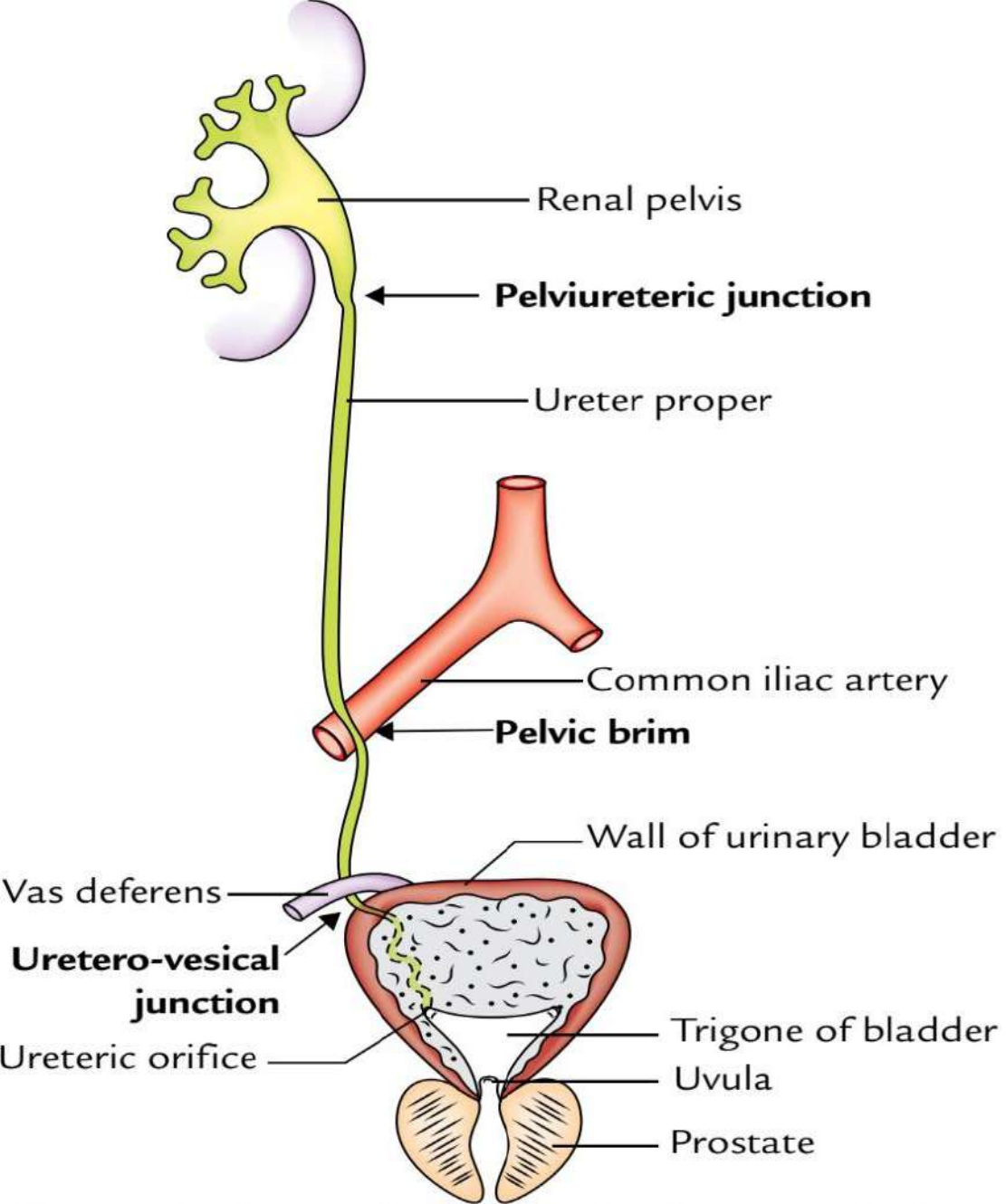
Parts:

- **Abdominal**: upper 1/2.
- **Pelvic**: lower 1/2.
- **Intramural** (inside urinary bladder).

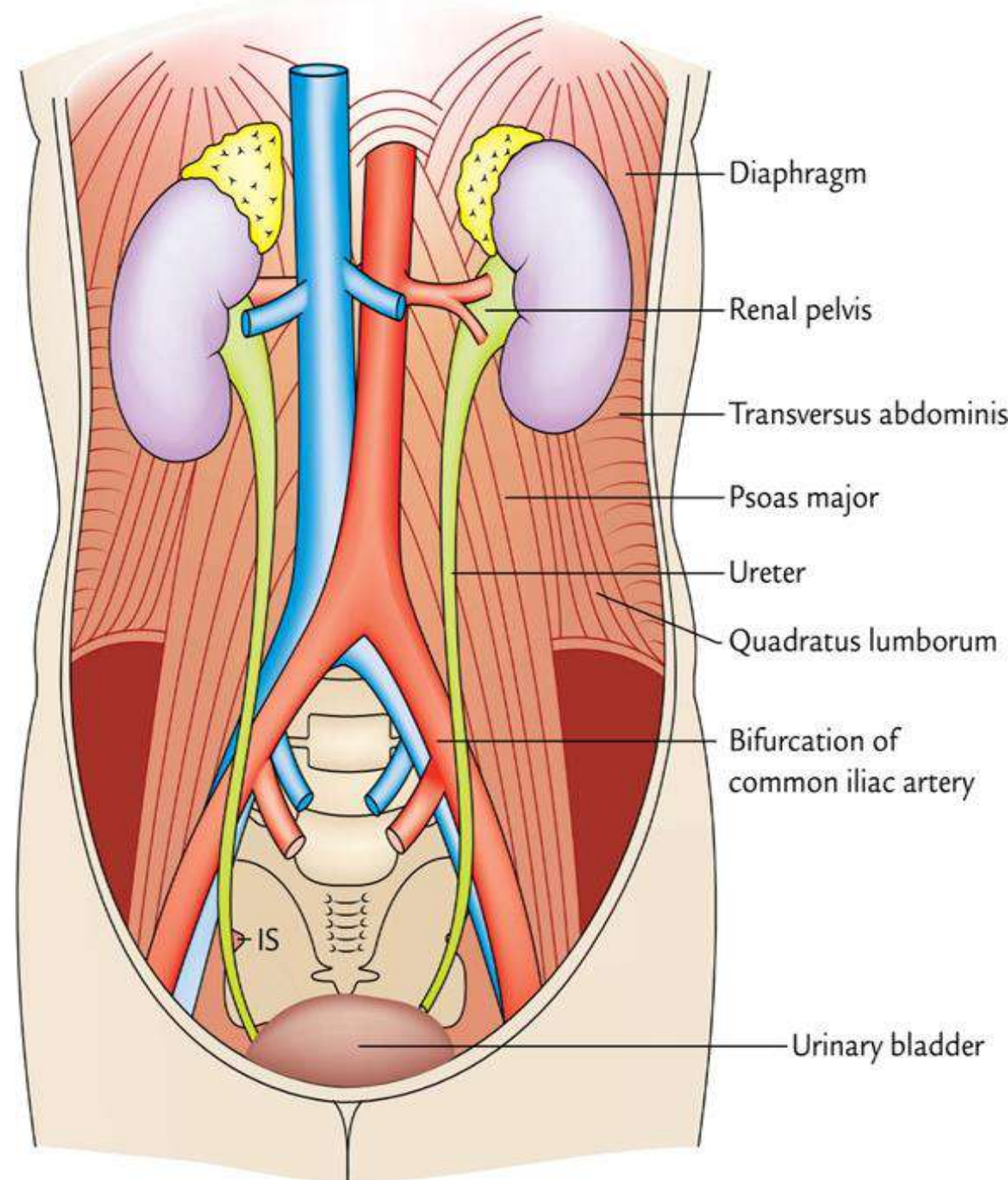
Anatomical stricture: صون مكان جمع الحصوات → أماكن ضيقة

1. At the **pelviureteric junction**.
2. Where it crosses the **pelvic brim (common iliac artery)**.
3. At its **termination in the bladder mucosa**.

pelvis مدخل



Normal sites of anatomical constrictions in the ureter (arrows).



Course of the ureters (IS = ischial spine).

URINARY SYSTEM

Urinary Bladder

تقلص
بجهد
↑

مستودع للبول

- The urinary bladder is a muscular reservoir for urine.
- It is located in the true pelvis between the **pubic symphysis and rectum in the male** and between the **pubic symphysis and uterus in the female**.
- The bladder has widely varying capacity (**average about 200-300 mL**).
- In the male, the **prostate** gland is positioned **below** the neck of the **urinary bladder**.

Parts of the urinary bladder

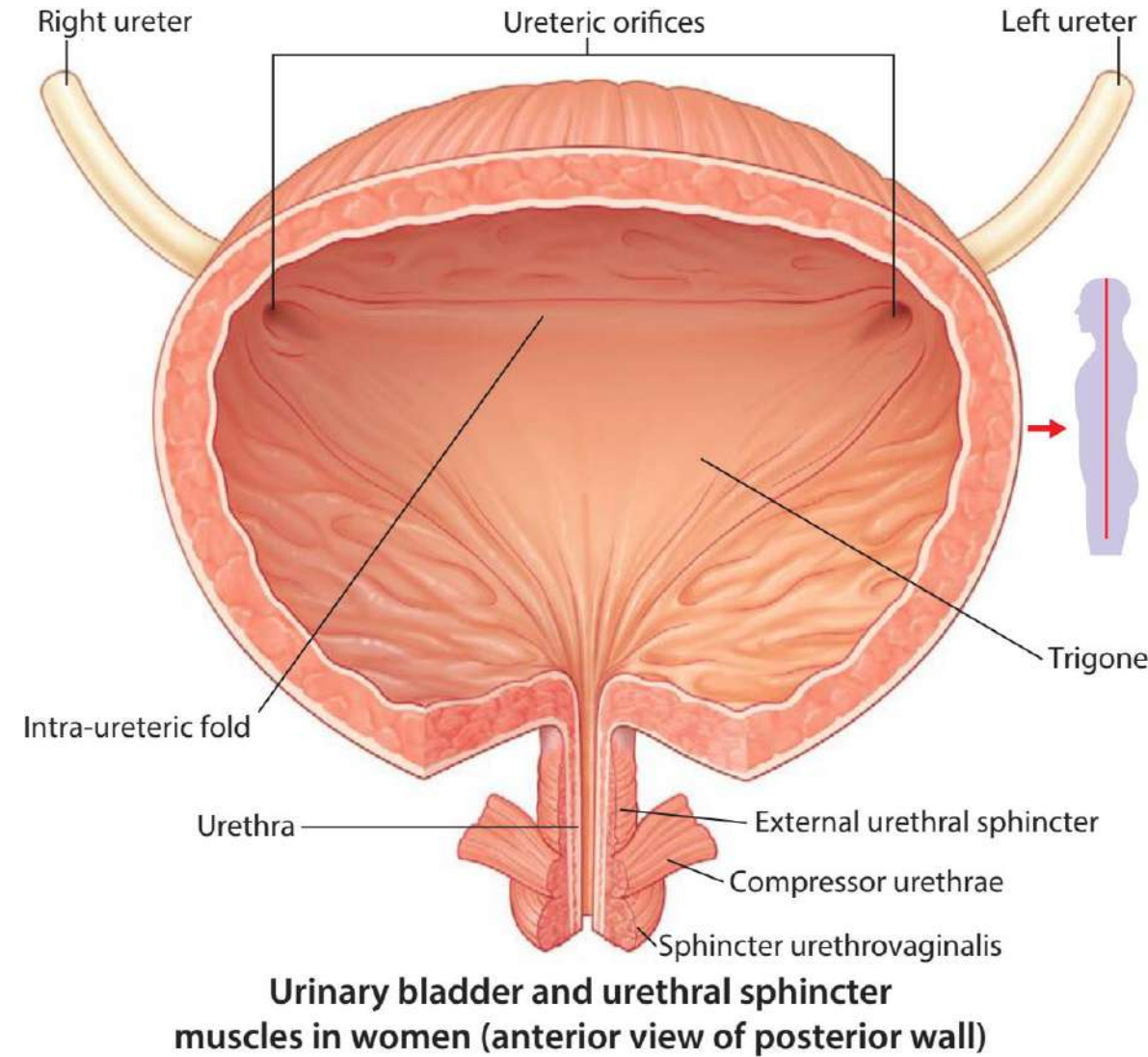
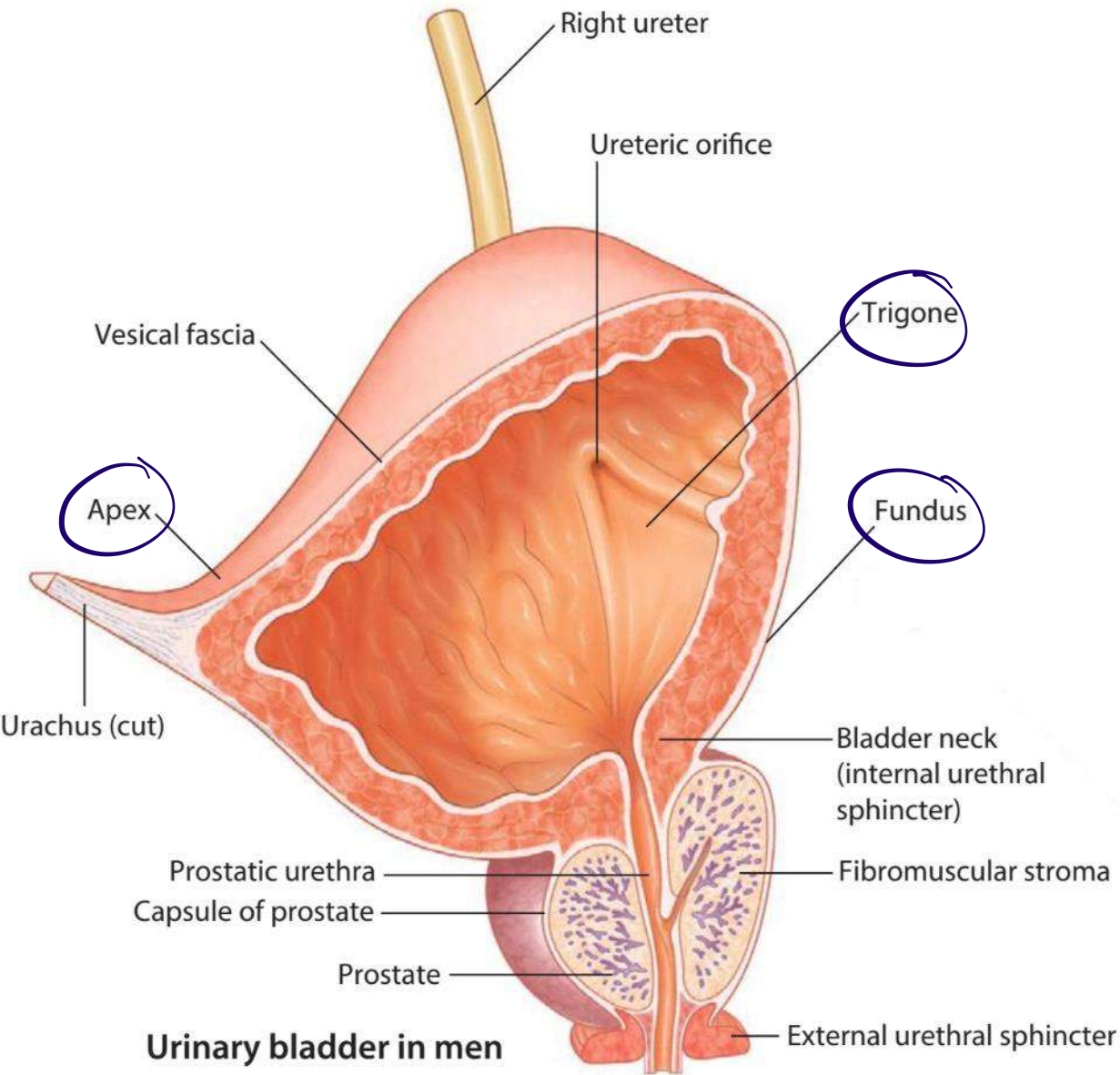
— لما تكون مليانة تكون شبه البالون ، ما إياها حدرد
— لو خافتة إياها تقال محين

The shape of urinary bladder is determined by the volume of urine it contains. An **empty** bladder is pyramidal in shape with an apex, body, fundus and neck.

- The **apex** directed upward and is secured by median umbilical ligament.
- The **body** receives the ureters along the supralateral angles
- The **neck** is the most fixed part of the urinary bladder and the urethra exists at its neck.
- A **triangular area** between **the two ureteric openings** and a **single urethral opening** is called **trigone of the urinary bladder**. Over the trigone, the mucous membrane remains smooth even if the bladder is empty.

وهذا جزء غير قابل للتمدد .

URINARY SYSTEM



URINARY SYSTEM

Urethra

- The urethra is a tubular continuation of the neck of the urinary bladder.
- It conveys urine from the urinary bladder to the outside of the body. The urethra has two muscular sphincters: (a) internal and (b) external.

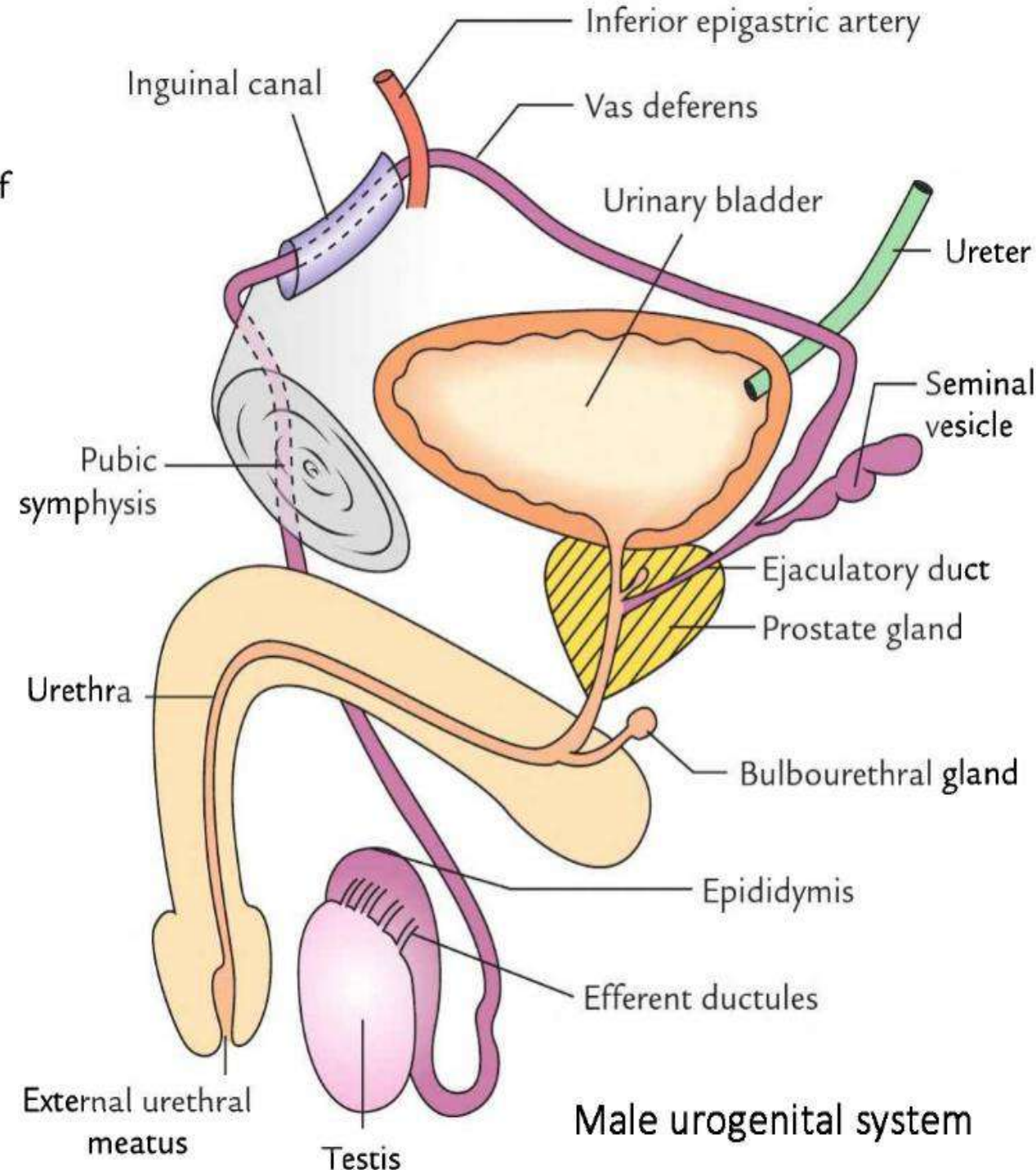
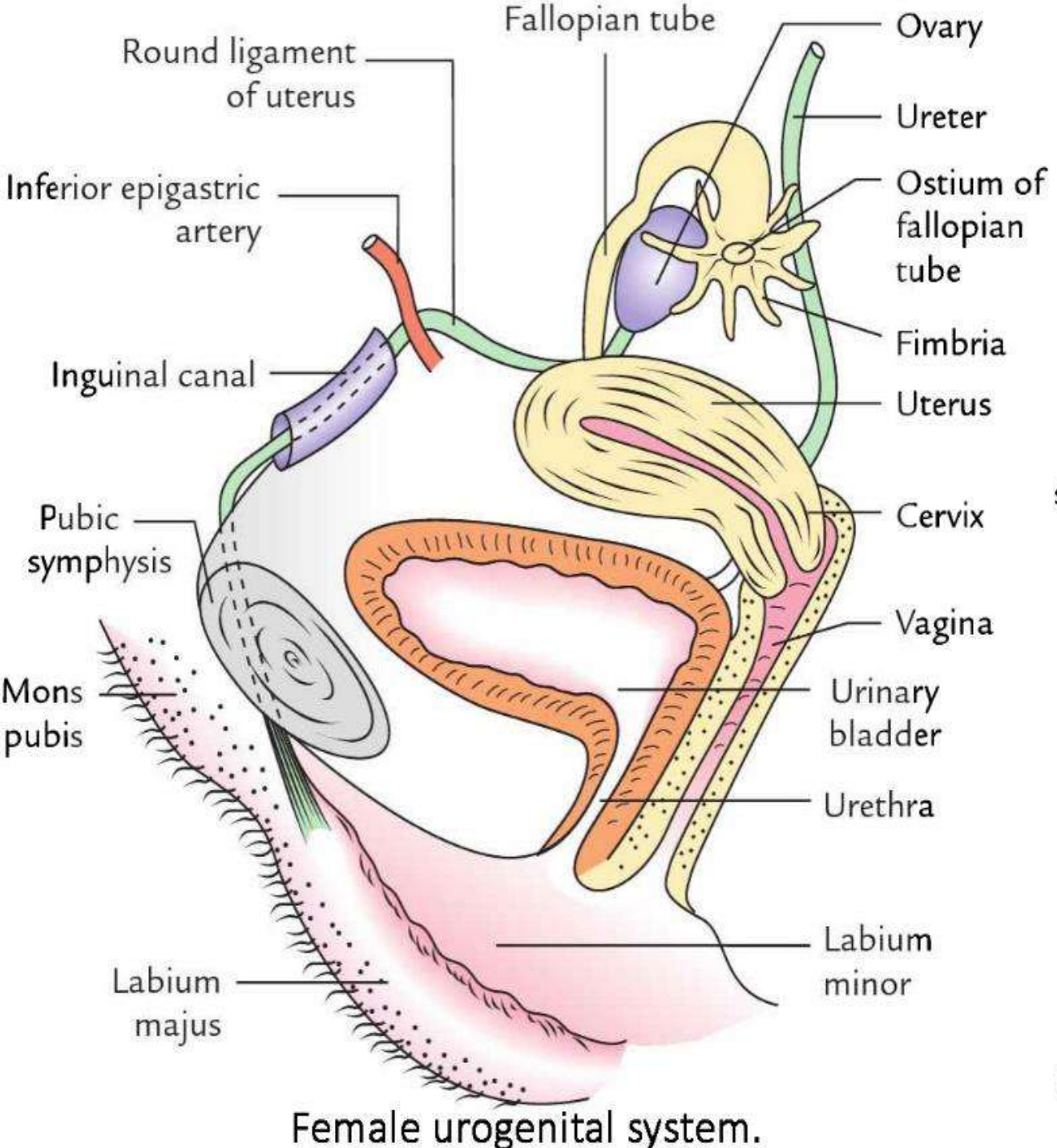
(a) **The internal urethral sphincter** at the junction of the bladder and urethra is formed by detrusor muscle of the urinary bladder. It is **involuntary in nature** and well-developed in females. (Autonomic N.S) *يتركب من*

(b) **The external urethral sphincter** is formed by the sphincter urethrae muscle of the urogenital diaphragm. It is made up of skeletal muscle fibers, hence **voluntary in nature**.

The male urethra is long, about 20 cm (3 in.) in length and S-shaped.

- It traverses the prostate gland, urogenital diaphragm and penis to empty outside the body.
- It has 3 parts: **prostatic**, ^{Intermediate} **membranous** and **penile (spongy)** parts

The female urethra is short, about 4 cm (1.5 in.) long and empties urine into the vestibule of the vagina.



LYMPHATIC SYSTEM → Connection of lymph مسؤول عن

جهاز وعائي

▪ **Definition:** a part of the vascular system, concerned with collection of lymph.

▪ **Functions of lymphatic system:**

1. Drains excess ^{extra cellular fluid.} tissue fluid to the venous system, i.e. tissue fluid which could not be drained by the venous system.
cytoplasm → Intracellular fluid داخل الخلية
tissue fluid → extra cellular fluid خارج الخلية
2. Absorbs fat from the intestine and transports it to the blood.
3. Helps to provide immunological defenses against disease causing agents.

▪ **Parts:**

- (a) Lymph. → السائل الليمفاوي
- (b) Lymphatic vessels. → أوعية
- (c) Lymphoid tissue → immunity function

LYMPHATIC SYSTEM

1. The Lymph:

Definition:

تعريف: شفاف

عشان هو كان extra و به يصير intra

- Clear colorless fluid which escapes from the capillaries by filtration into the tissue spaces as it becomes tissue fluid.
- It returns back to blood stream through lymph vessels.
- The lymph fluid from the digestive tract has a milky appearance specially after meal.

circulatory sys

لأنه حامل lipids + proteins
عشان يستعملها الجسم

Composition:

- Plasma.
- Proteins.
- Lymphocytes.
- Others as waste products and micro-organisms.

متعلقة بالمناعة →

مثل البكتيريا وهما lymphocyte بتقتلها

هلا أنا عندي cell membrane و هاد
كتوي على Antigen موجودة على البروتينات
و لما يصير اشئ غير طبيعي في الجسم
تتدبر عليه lymphocytes و تتدبر بوضع
البكتيريا و تعمل عملية بلعمة للبكتيريا و تقتل
إنزيمات تلتس بروتينات البكتيريا و ما يطبع waste product

LYMPHATIC SYSTEM

2. Lymph vessels (lymphatics): 3 Types according diameter.

1) **Lymphatic capillaries**: ^{هدود أخصر اش} Fine, ^{ما في نهاية لهم} blind-end, valveless tubes; unite with each other to form **smaller** vessels which join to form **larger** lymph vessels. *Capillaries → small → large*

2) **Lymphatic vessels**: *large* ^{Thin wall} *against gravity*

- Thin-walled, multivalved like veins. The valves inside the lymph vessels give their beaded appearance and keep the direction of lymph drainage toward the venous blood stream.
- The smaller lymphatics join together to form larger vessels called lymph **ducts**.

3) **Lymphatic ducts**: Two main lymphatic ducts are present in the body.

1. **Right lymph duct**: Drains lymph from the right side of the head & neck, thorax and right arm.

2. **Thoracic duct**: Drains lymph from the rest of the body.

- Each duct **ends** into the corresponding brachiocephalic vein.

نهاية الشين

LYMPHATIC SYSTEM

3. Lymphoid tissue:

موجودة في الأطفال وتختفي عند البالغين
↑

- It includes **lymph nodes** and other collections of lymphoid tissues such as: **thymus**, **palatine tonsils**, **adenoids** and **spleen** (The largest lymphoid organ in the body).

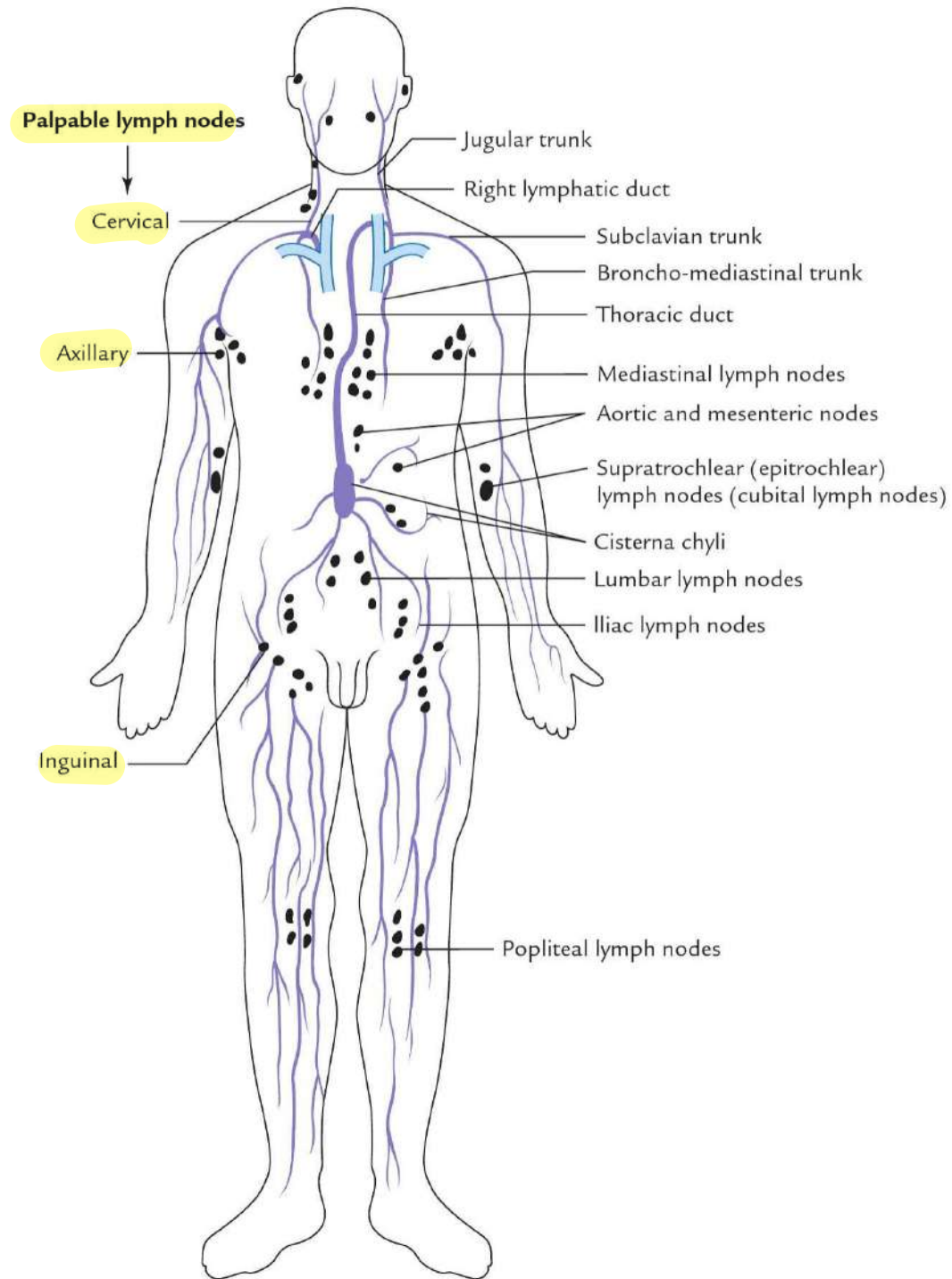
Lymph nodes (glands):

- The lymph passes through lymph nodes before reaching the main lymph vessels.
- They act as filters preventing the passage of germs and their toxins to the blood stream.
- They are present in groups near the proximal ends of regional vessels.

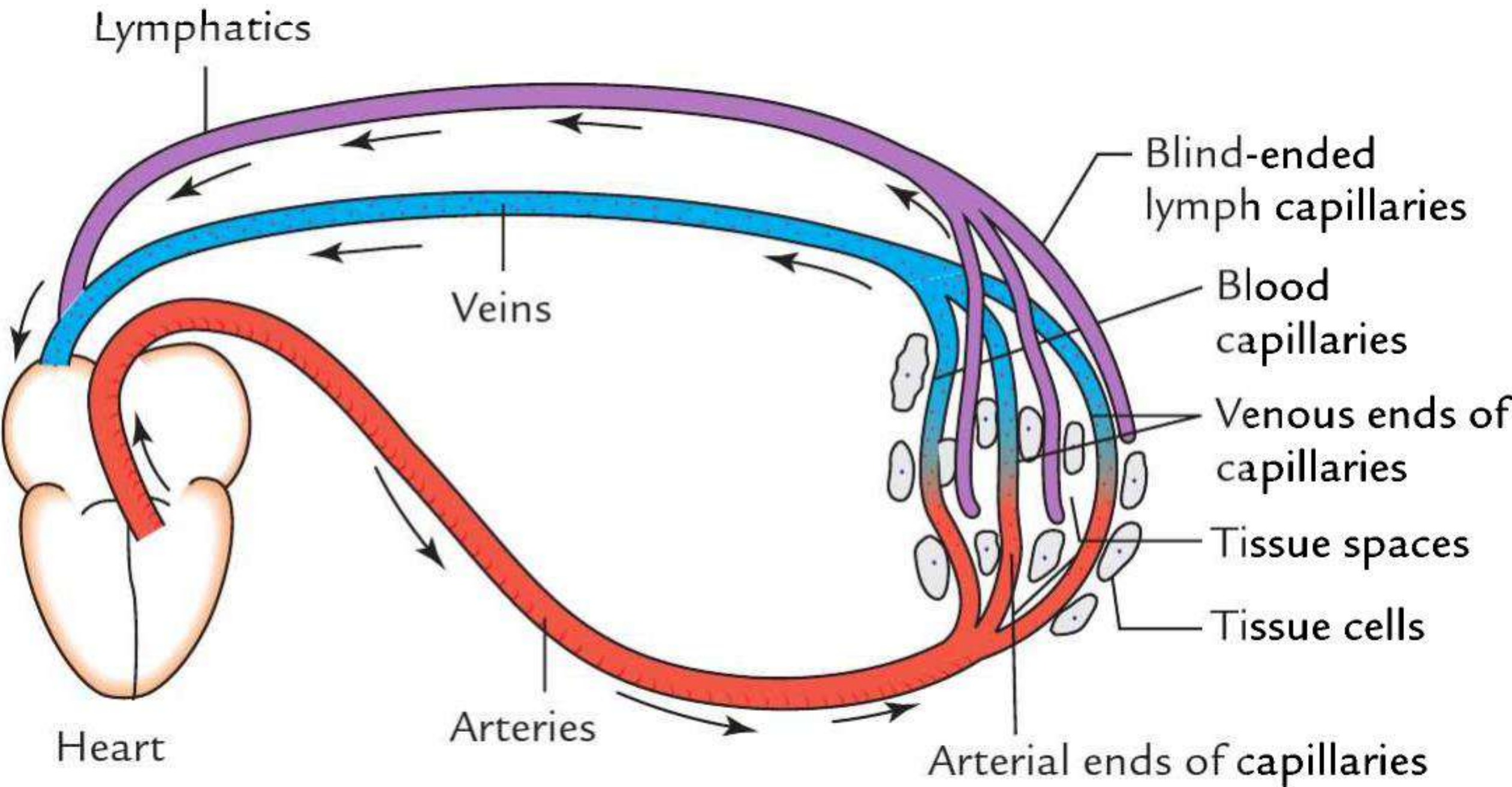
Example:

- Axillary**: for upper limb & breast.
- Cervical**: for head & neck.
- Mediastinal**: for thoracic organs.
- Inguinal**: for lower limbs.
→ superficial
→ deep
- Iliac**: for pelvic organs.
- Aortic**: for abdominal organs.

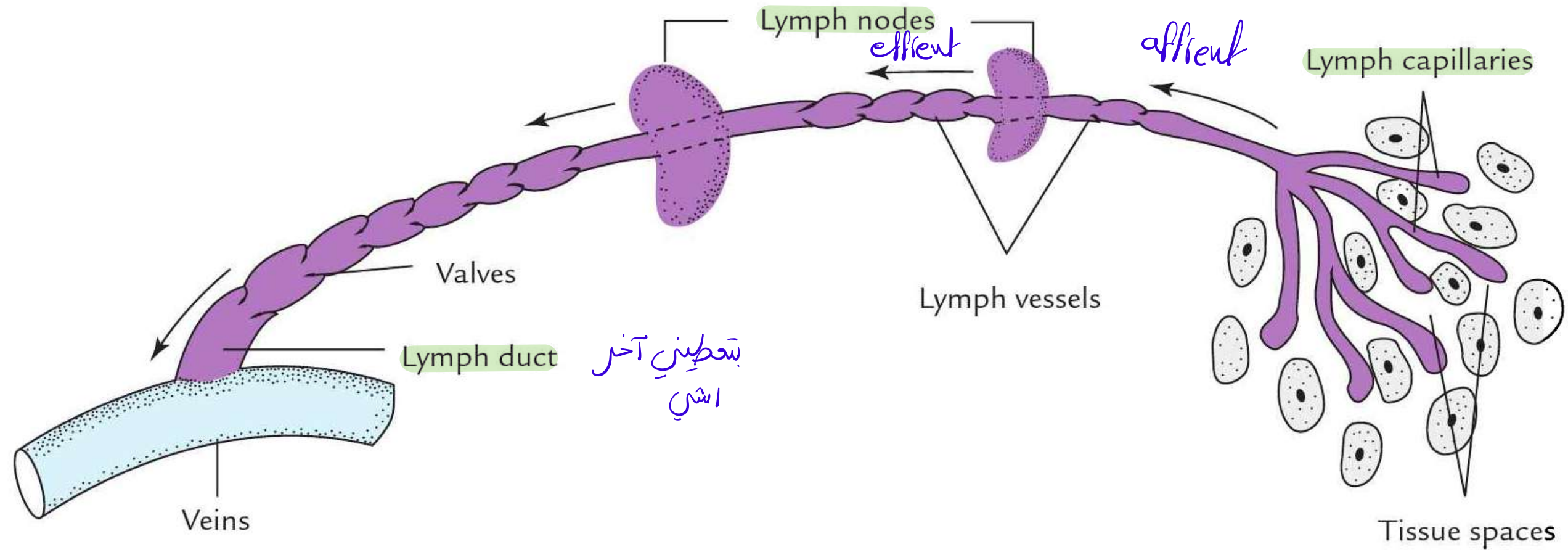
Lymphatic Nodes :



LYMPHATIC SYSTEM

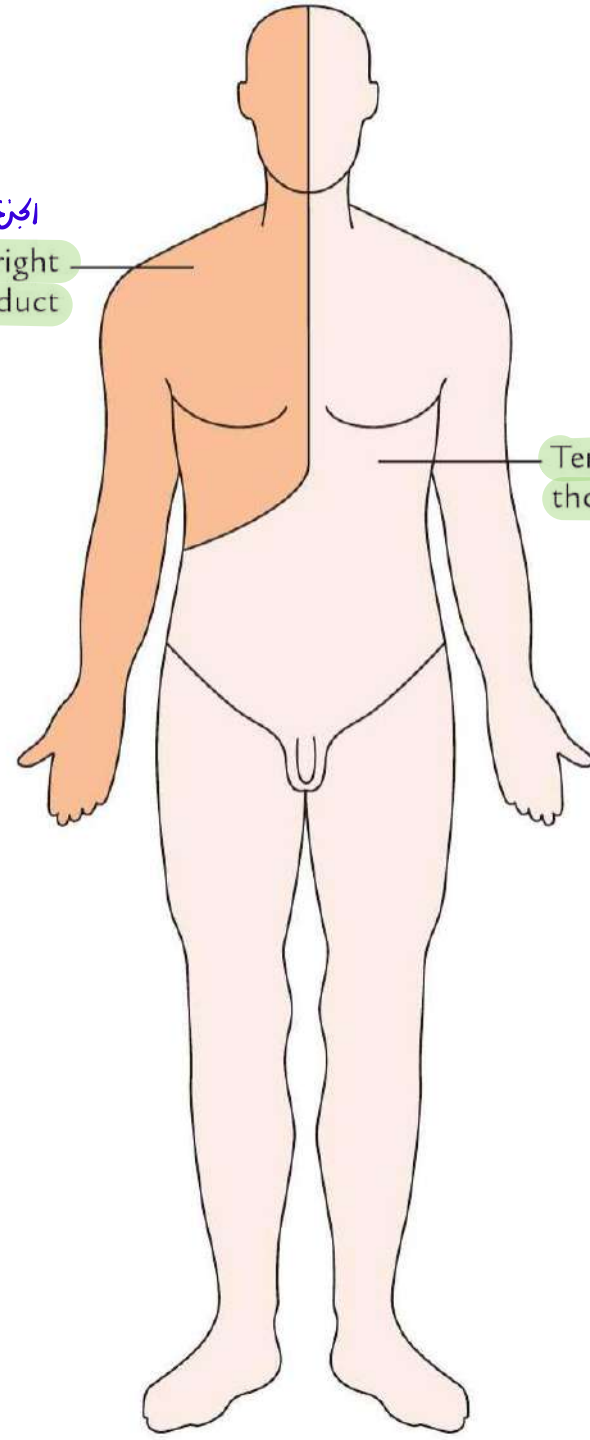


LYMPHATIC SYSTEM



lymphatic duct
جزء الخاصة به

Territory of right lymphatic duct



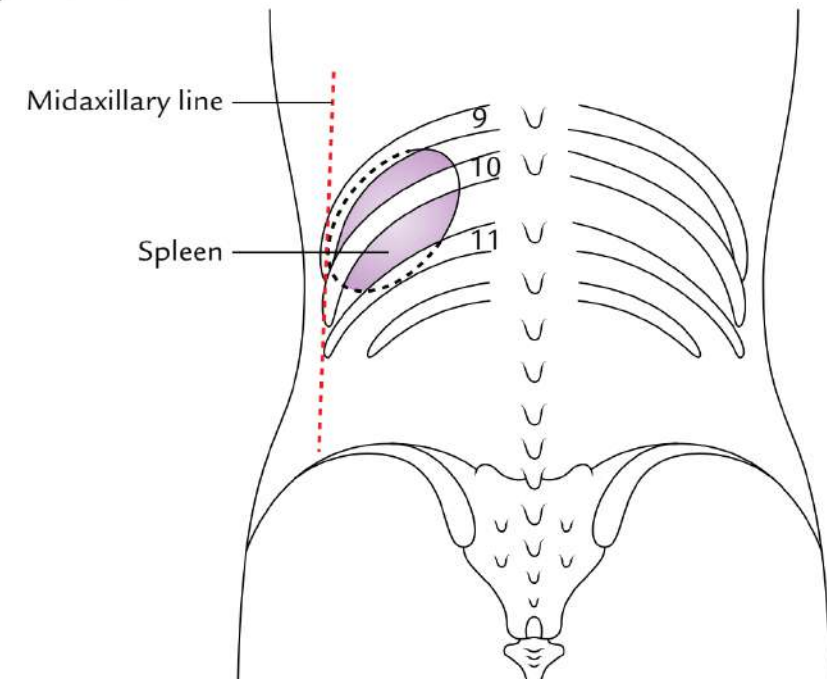
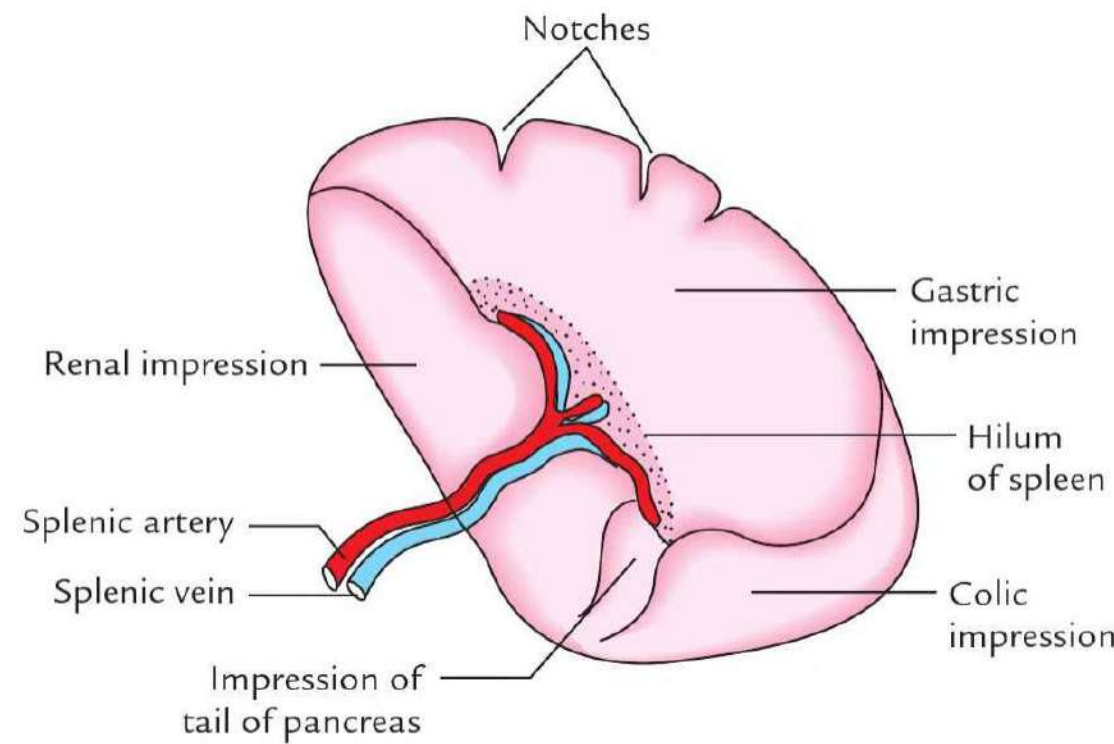
Territory of thoracic duct

يأخذ من
left + right
lower limbs
+
abdomen

LYMPHATIC SYSTEM

Spleen

- The spleen is the largest lymphoid organ in the body.
 يتعامل مع الدم مباشرة
دهون تتكلس RBCs وتغير تدوير HB
- It is located deep in the left hypochondrium of abdominal cavity between fundus of stomach and the diaphragm.
- It is purplish and varies in size in different individuals. Usually it is of the size of a closed fist of that individual.
 - الحجم -
 - يختلف من
 - شخص لآخر
- It is related to 9, 10 and 11 left ribs
 upper lower
- It has a hilum through which passes splenic artery and vein and is related to tail of pancreas



ENDOCRINE SYSTEM

تissue يعمل إفراز
Blood
ducts ← شغلة
↑

The **glands** are classified according to its structure and function into:

- **Exocrine glands:**
 - Pour its secretions through **ducts**. *Example;* sweat and salivary glands
- **Endocrine (ductless) glands:**
 - Pour its hormones directly into the **blood**. *Example;* pituitary and thyroid glands.
- **Mixed glands:**
 - They have exocrine and endocrine functions. *Example;* pancreas.

Endocrine system → شئ بديل لـ NS بين بعض
NS صور بتحكم فيه

- The endocrine system is one of the two major control systems of the body (the other being the nervous system) and plays an important role in maintaining the homeostasis of the body.
- The disorders of the endocrine system lead to important clinical conditions such as diabetes mellitus, diabetes insipidus, Cushing's syndrome and varieties of reproductive malfunctions.

The endocrine system consists of:

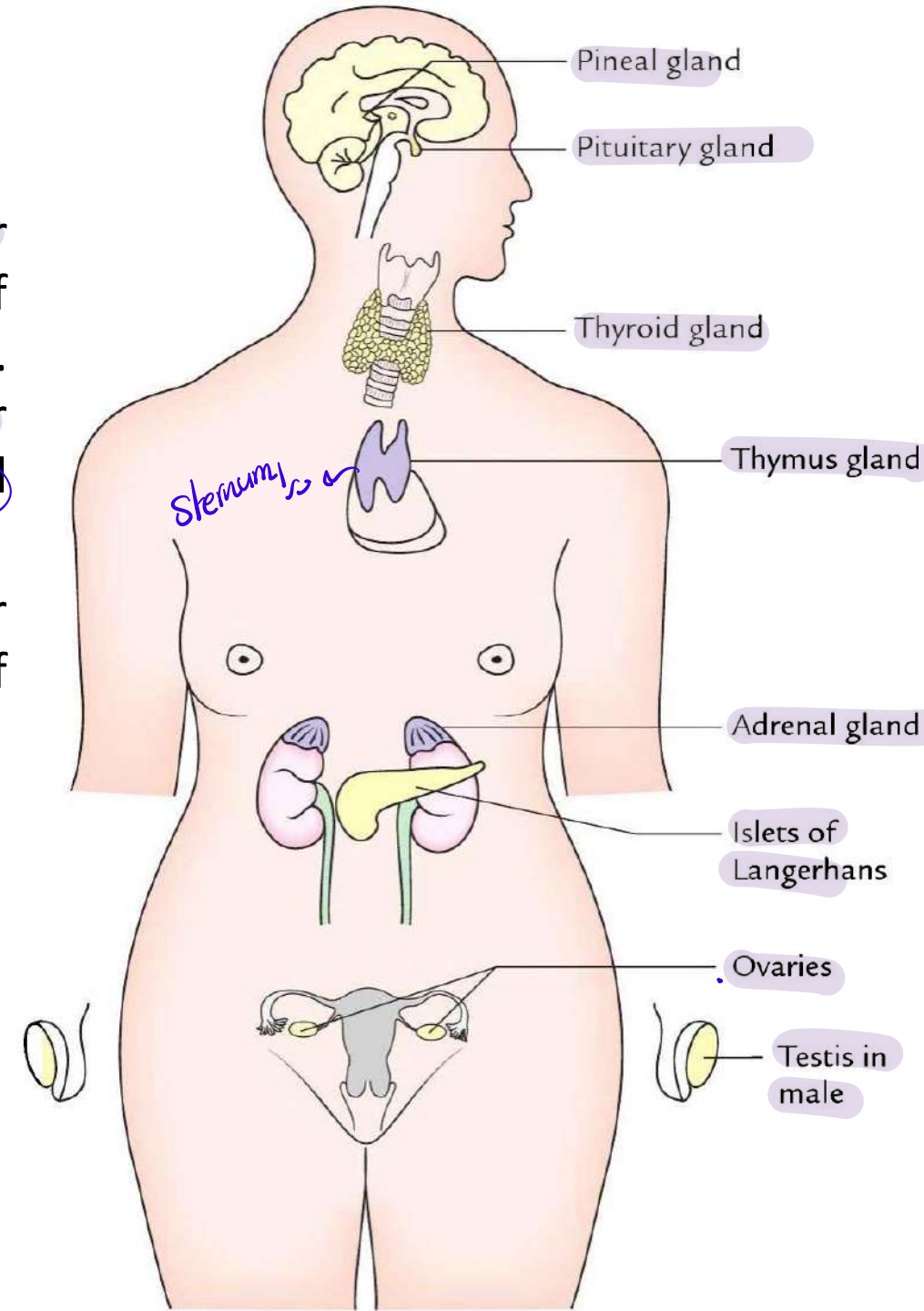
1. Endocrine glands, which exist as separate distinct organs, viz. pituitary, thyroid and parathyroid glands.
2. Scattered masses of endocrine cells within the exocrine glands, viz. islet of Langerhans within pancreas, interstitial cells of testis, corpus luteum of ovary, etc. → cells in organ
3. Diffuse neuroendocrine cells, viz. neuroendocrine cells distributed in the lining epithelium of duodenum, stomach etc.

in GIT

ENDOCRINE SYSTEM

Endocrine glands

- The **endocrine glands** are ductless glands and pour their secretion directly into the bloodstream. The cells of endocrine glands abut directly against the vascular channels. Most of such groups of gland cells are arranged in cords or plates. These cords are separated by **sinusoids** or **blood capillaries**.
- The secretion of endocrine glands is known as **hormone** or **chemical messenger** which cause **activation** or **inhibition** of even a distantly situated target tissues and/or organs.
Action: →
- The important endocrine glands of the body are as follows:
 1. Pituitary gland or hypophysis cerebri
 2. Thyroid gland
 3. Parathyroid glands
 4. Suprarenal (adrenal) glands
 5. Pineal gland
 6. Thymus gland *Jx*



ENDOCRINE SYSTEM

الغدة الخامسة

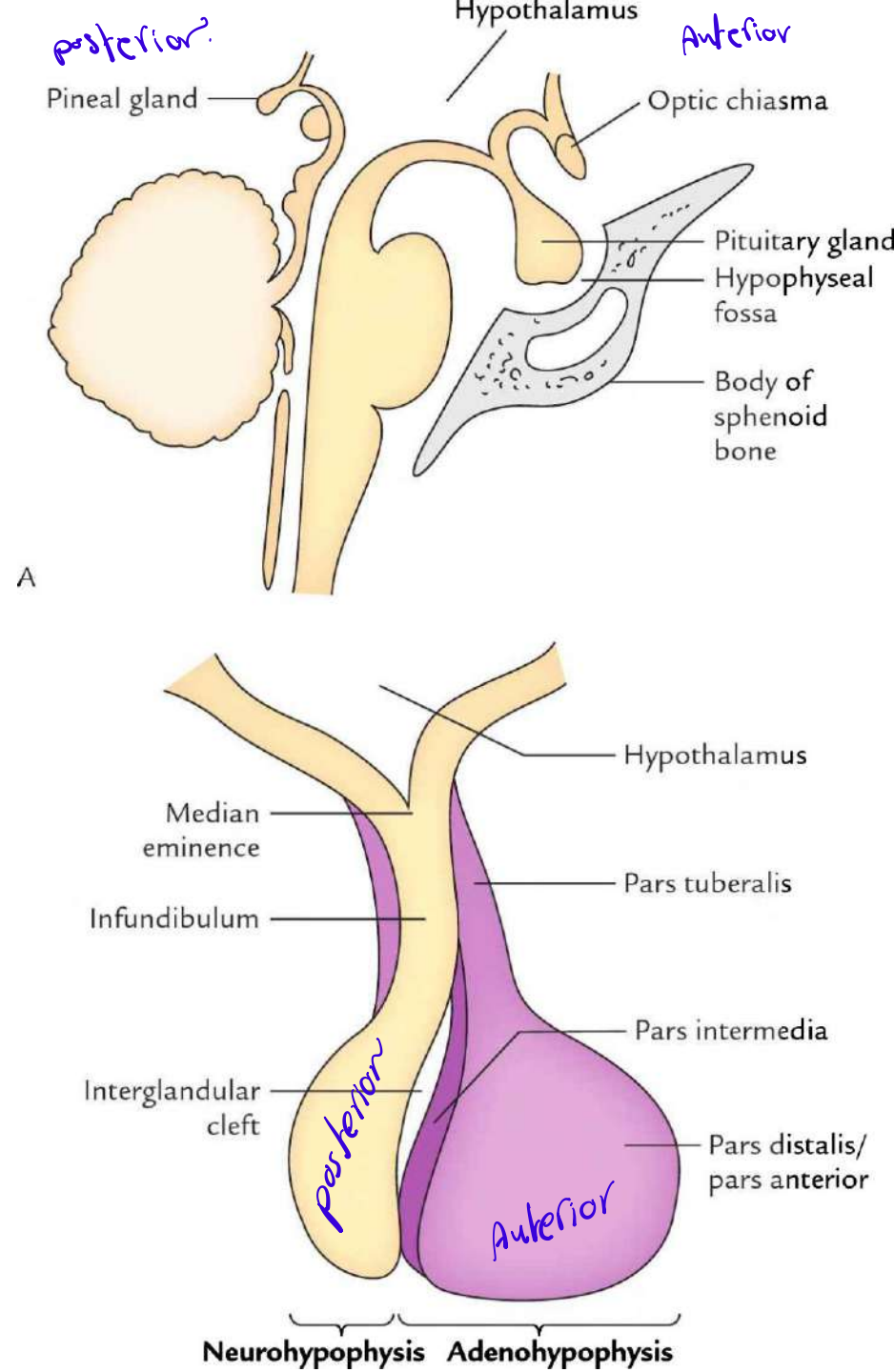
Another name

Pituitary gland (Hypophysis Cerebri)

- The **pituitary gland** is the most **complex endocrine gland**.
- It **weighs** about **0.5 g** and its normal dimensions are **10 mm X 13 mm X 6 mm**.
- It is located in the **bony fossa of the skull (pituitary fossa or hypophyseal fossa or sella turcica)**, **below the hypothalamus** and connected to it by a stalk of tissue called **infundibulum**.

The pituitary gland consists of **two distinct parts**:

1. **Adenohypophysis (anterior pituitary)** *Adeno → gland*
2. **Neurohypophysis (posterior pituitary)** *connected to **N.S.***



ENDOCRINE SYSTEM

Anterior → excretory function
posterior → storage function

Function of Pituitary gland

- **Adenohypophysis** (Anterior Pituitary) has a type of cells called **Chromophils** which possess **secretory granules**.
لونها غامق
- The **chromophils** are of two types: **acidophils** and **basophils**:
 - (a) **Acidophils**: According to the function, the acidophils are classified into the following three types:
 - (i) **Somatotrophs**: They regulate **body growth** by secreting **GH** (growth hormone).
 - (ii) **Corticotrophs**: They act on **suprarenal glands** by secreting **ACTH** (adrenocorticotrophic hormone).
هرمون الكورتيزول
 - (iii) **Mammotrophs**: They act on **mammary glands** by secreting **prolactin hormone**.
 - (b) **Basophils**: According to their function, the basophils are classified into two types:
 - (i) **Thyrotrophs**: They act on **thyroid gland** by secreting **TSH** (thyroid-stimulating hormone).
الغدة الدرقية
 - (ii) **Gonadotrophs**: They act on gonads by secreting:
 - **FSH** (follicle-stimulating hormone)
 - **LH** (luteinizing hormone) in **females**
 - **ICSH** (interstitial cell-stimulating hormone) in **males**
- **Neurohypophysis (Posterior Pituitary)** does **not secrete any hormone**, rather it **simply serves as a depot for the storage of the hormones** (**antidiuretic hormone** and **oxytocin**) **secreted in the hypothalamus**.
مضاد لإدرار البول . صدر البول ↓

ENDOCRINE SYSTEM

Thyroid gland

- Thyroid gland is the largest endocrine gland of the body and weighs about 20 g. It lies in front of the lower part of the neck.
- It consists of two lateral lobes connected by an isthmus.
- The lobes are conical in shape and are placed on either side of the upper part of trachea and lower part of larynx.
- The isthmus extends across the anterior aspect of the trachea opposite the 3rd and 4th tracheal rings.

Function:

- The thyroid gland secretes three hormones:

1. **T3 (triiodothyronine or thyroxine)** secreted by cuboidal cells of thyroid follicles.

2. **T4 (tetraiodothyronine or thyroxine)** secreted by cuboidal cells of thyroid follicles.

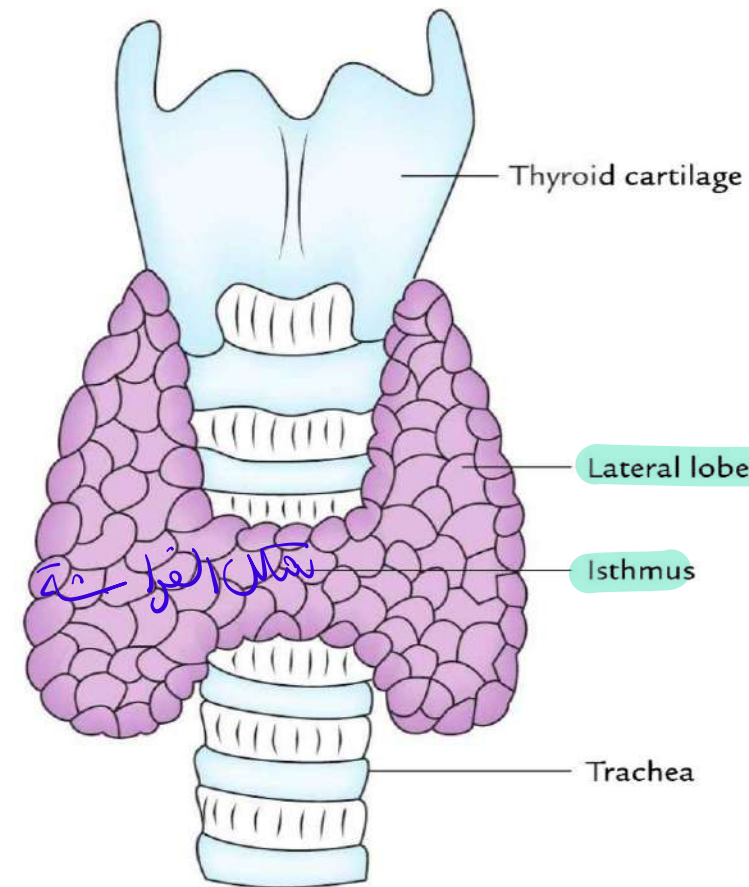
The T3 and T4 are essential for growth of the body.

They also maintain BMR (basal metabolic rate) of the body. In peripheral tissues,

3. **Calcitonin (thyrocalcitonin)** secreted by parafollicular cells.

The calcitonin plays an important role in calcium homeostasis.

It lowers the blood calcium level when calcium level is elevated.



عند بعض النساء يكون عندهم تضخم الغدة الدرعية بسبب نقص اليود، فالغدة الخاصة بتفكر انه ما في Thyroxine وتلبس تفرزه وتلبري الحجم وصار سبب انه الملح يحترق على اليود وعشان نقصه النقص.

ENDOCRINE SYSTEM

Parathyroid glands

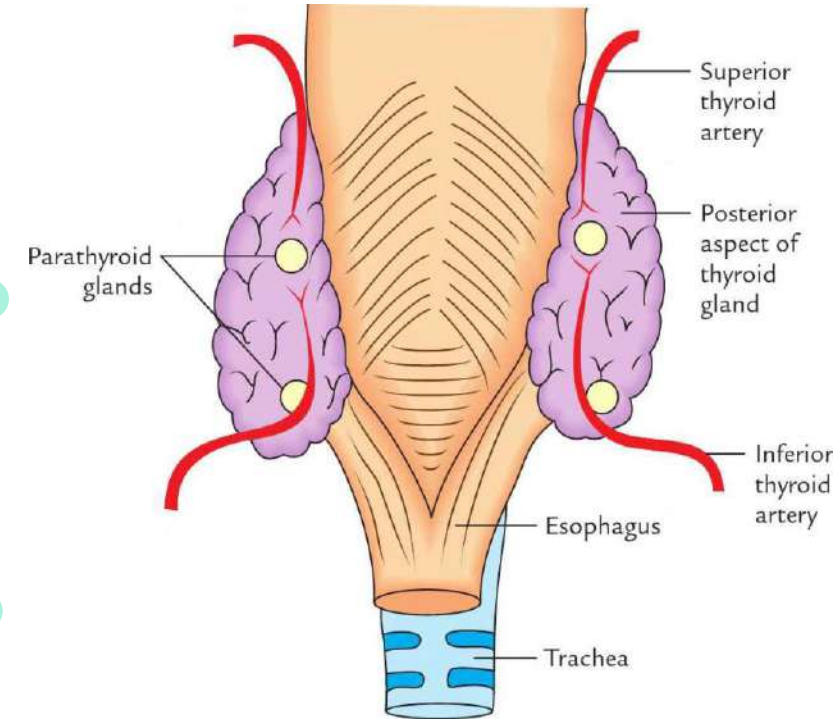
- There are **four parathyroid glands**.
- They are **small, oval, yellowish brown bodies** measuring about 2X3X5 mm, roughly equal to the size of a split pea.
- The **two (superior and inferior) parathyroid glands** are **found embedded on the posterior surface of each lateral lobe of the thyroid gland**

Function:

- The parathyroid glands secrete **parathyroid hormone (PTH)**. The **parathyroid hormone** (also called **parathormone**) is important in **maintaining blood calcium level**. It mobilizes calcium from bones and raises blood calcium level.
- In addition, it **inhibits osteoblastic activity** and **promotes osteoclastic activity** of bone. *active*
- Further, it **converts vitamin D into an active principle 1,25-dihydroxycholecalciferol** in the kidney and thus increases absorption of calcium into the kidney.

NB.: *نقل Ca في الدم يزيد* Parathormone and calcitonin from the thyroid gland act in a complementary manner to maintain blood calcium levels within a normal range. This is needed for the following functions:

- Muscle contraction**
- Blood clotting**
- Nerve impulse transmission**



شرح بالزيتوني شرح الفسيولوجي
• محاضرة endocrine

ENDOCRINE SYSTEM

Suprarenal glands (adrenal glands)

- There are **two suprarenal glands, the right and the left** situated on the upper pole of each kidney.
- The right suprarenal gland is shaped like a hat ^{مقبع} and the left is semilunar in shape.
- Like kidneys they are retroperitoneal and surrounded by abundant adipose tissue. They are about 4 cm long and 3 cm thick.

Structure and Secretion of Hormones

- Each suprarenal gland is a composite organ consisting of two distinct parts:
- (a) an outer part, called **adrenal cortex**.
- (b) an inner part, called **adrenal medulla**.

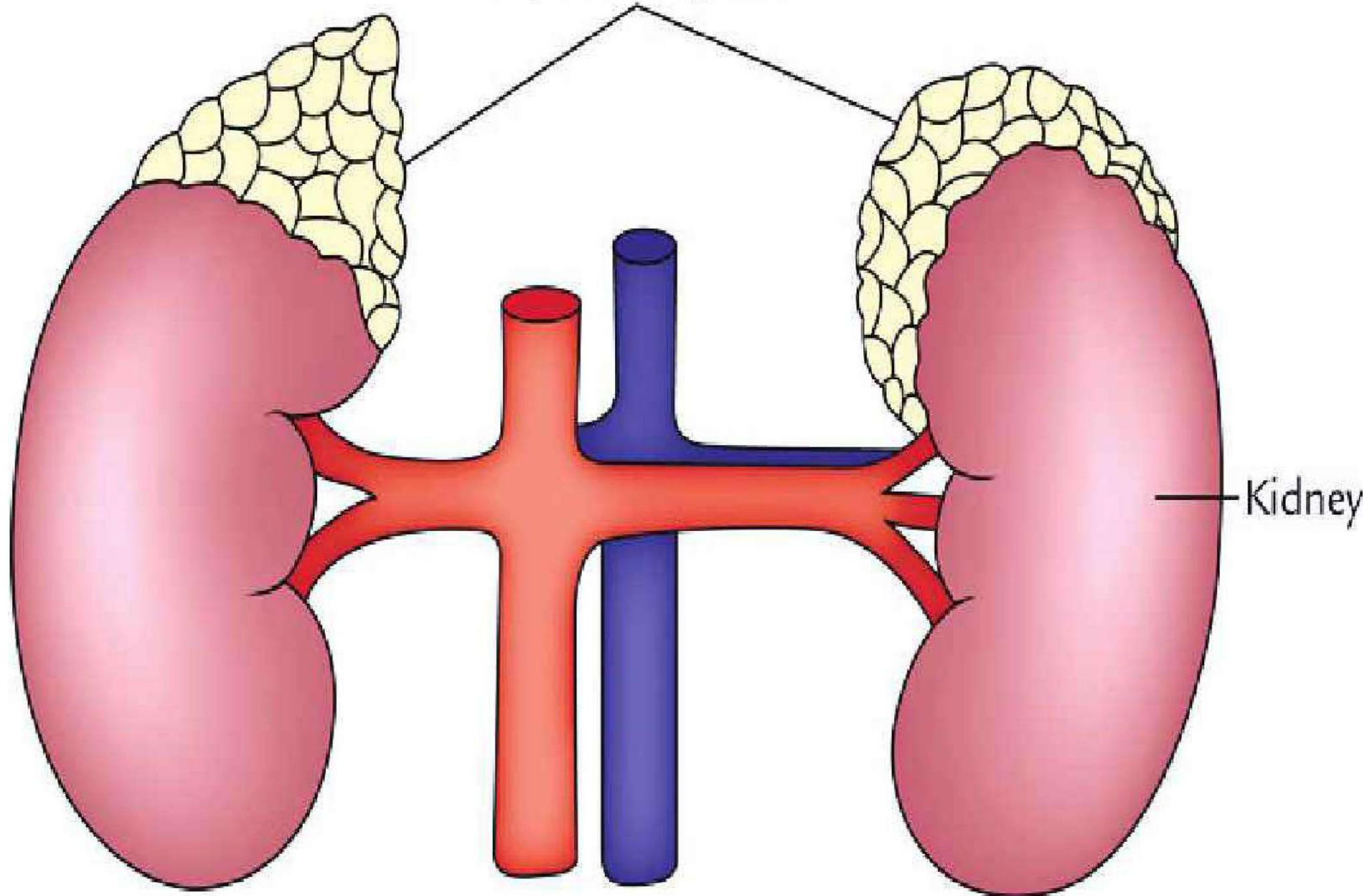
Adrenal Cortex: The adrenal cortex is the outer larger part of the adrenal gland. It is divided into **three distinct zones**:

- An outer zone, called **zona glomerulosa**. secretes **mineralocorticoids**
- A middle zone, called **zona fasciculata**. secretes **glucocorticoids** → من هورمون الكورتيزول
- An inner zone, called **zona reticulata**. secretes **adrenal androgens (sex steroids)**

Adrenal Medulla: The adrenal medulla is the inner soft part of the adrenal gland.

- The cells of adrenal medulla are called **chromaffin cells** because **secretory granules** within their cytoplasm specifically **stain brown** when treated with potassium dichromate solution. ^{تصبغ الصبغة}
- The chromaffin cells** secrete **catecholamines** which are of two types, **epinephrine** and **norepinephrine**.
- Release of catecholamines** from the medulla is controlled by **sympathetic nerves**. (Autonomic NS)

Suprarenal glands



Kidney

ENDOCRINE SYSTEM

Scattered masses of endocrine cells in exocrine glands

- In addition to the presence of endocrine tissues in distinct endocrine glands such as pituitary, thyroid, etc., some endocrine tissues such as **islets of Langerhans of pancreas, interstitial cells (Leydig cells) of testis, corpus luteum of ovary** occur as scattered mass within an exocrine gland.

Diffuse neuroendocrine cells

- There are certain scattered neuroendocrine cells such as
 - (a) **Rennin-producing juxtaglomerular cells of the kidney.**
 - (b) **Gut-associated endocrine cells** or **enteroendocrine cells**, found scattered in the epithelial layer of mainly **stomach and small intestine.**
 - The enteroendocrine cells of the stomach produce **gastrin** which acts on the fundic glands of the same organ.

شکرا