

ENDOCRINE SYSTEM

Anatomy & Histology
Lec. 5

الطبيب



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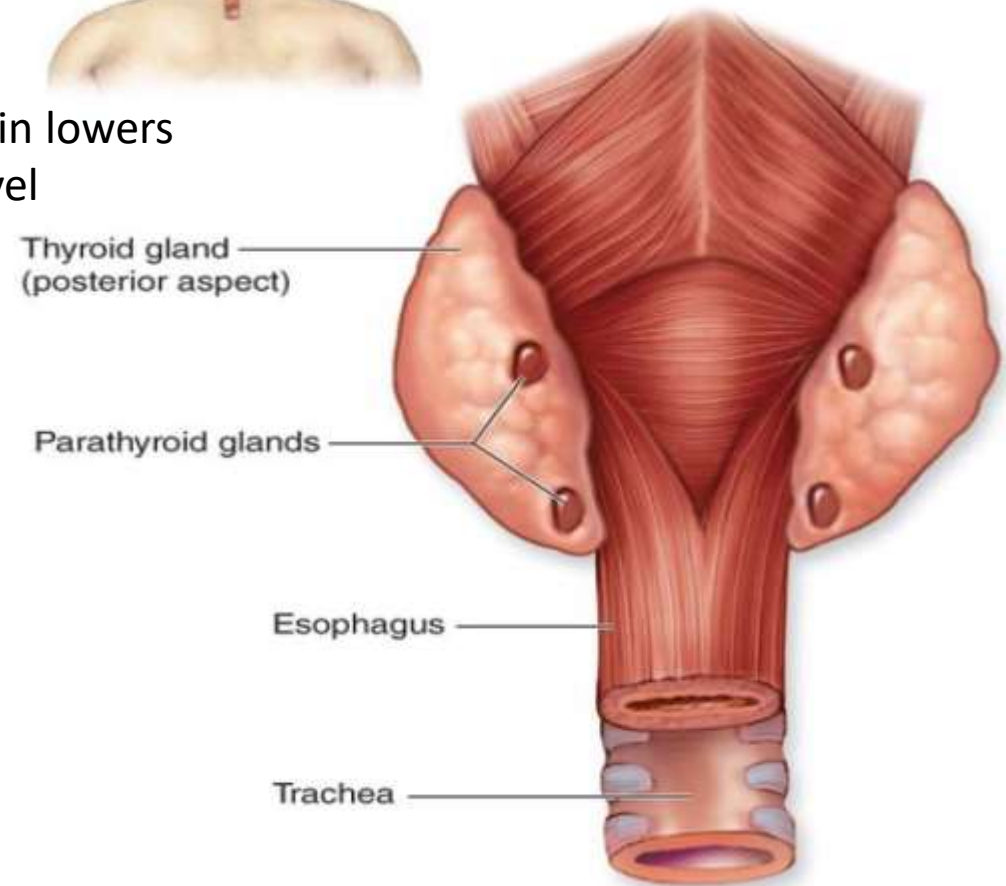


ما ينطق به الدكتور من شرح سيكون باللون الاحمر
ما يكون مهم في السلايدات او الشرح يكون بخطين أو بخط

Parathyroid glands

They are named so because of their location near the thyroid gland .

Calcitonin lowers
 Ca^{+2} level



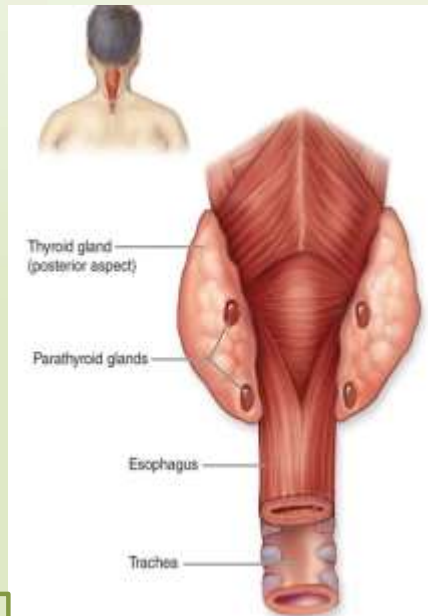
Anatomy/ Characteristics

We do have some variations but the doctor said that we wont go into these details

Blood supp./Venous D./ Lymph D.: same as thyroid

- Four small ovoid masses—3 × 6 mm—total weight 0.4 g.
- Located on the back of the thyroid gland, usually embedded in the gland's capsule.
- Closely related to the posterior border of the thyroid gland (posterior to the lobes NOT related to isthmus)

Increasing age---many secretory cells are replaced with adipocytes (>50%) of the gland in older people.



- The two superior parathyroid glands are the more constant in position--- lie at the level of the middle of the posterior border of the thyroid gland (near the superior thyroid artery and the external laryngeal nerve)...this means that you should find it where the branches of the superior thyroid artery penetrate the thyroid .However, you should look for it carefully as it is very small
- Contained within a thin capsule from which septa extend into the gland (septa) Within the septa there are small blood vessels which will later enter the paranchyma to form sinusoids
- The two inferior parathyroid glands usually lie close to the inferior poles of the thyroid gland (more or less closer to where the recurrent laryngeal nerve will join the inferior thyroid artery in most of the cases .

Notes on the previous slide.



-We are looking at the posterior surface of the thyroid gland, we can see 4 parathyroid glands arranged into two pairs

1-the superior pairwhich is actually in the middle of the posterior surface of the lobes (the word superior does not indicate that they are close to the apex)

2- the inferior pair , which is indeed located close to the base of the lobes.

-These glands are extremely small....each one of them is around 0.1 g

-These glands have a thin capsule around them which is attached to the capsule of the thyroid gland

-regarding cellular changes in the parathyroid, two things happen:

1-As we age , the amount of the adipose tissue in the gland increases.

2- we mainly have two types of cells in the parathyroid gland , one of them increases with age (oxyphils)

Notes on the previous slide.....cont

-what is the importance of the parathyroid glands?

Parathyroid hormone (PTH) release is enhanced when calcium levels decrease , thus it has an importance in maintaining calcium levels

-PTH has three major targets:

■ Osteoblasts respond to PTH by producing an osteoclast- stimulating factor that increases the number and activity of osteoclasts. The resulting resorption of the calcified (pay attention! PTH does not affect osteoclasts directly meaning that there is No PTH receptors on osteoclasts)

bone matrix and release of Ca^{2+} increase the concentration of circulating Ca^{2+} , which suppresses PTH production. The effect of PTH on blood levels of Ca^{2+} is thus opposite to that of calcitonin.

■ In the distal convoluted tubules of the renal cortex, PTH stimulates Ca^{2+} reabsorption (and inhibits phosphate reabsorption in the proximal tubules).

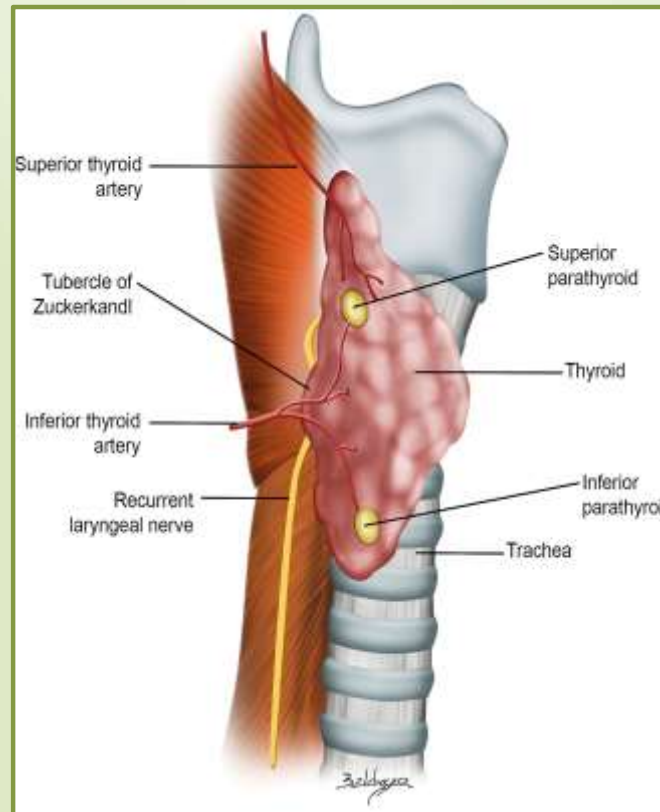
■ PTH also indirectly increases the Ca^{2+} absorption in the small intestine by stimulating vitamin D activation.

Anatomy/ Embryology

-The parathyroid glands are endodermal in origin.

Superior parathyroid glands

- Derived from the **fourth** pharyngeal pouch.
- Located near the posterolateral aspect of the superior pole of the thyroid, 1cm superior to the junction of the recurrent laryngeal nerve (RLN), and the inferior thyroid artery.



Inferior parathyroid glands

- Derived from the **third** pharyngeal pouch.
- Located near the inferior poles of the thyroid glands, within 1-2 cm of the insertion of the inferior thyroid artery into the inferior pole of the thyroid.
- Location is much more variable than the superiors: it can be intra-thyroidal (**totally embedeed**) or within the thymus or other mediastinal structures, and can even be found along the aortic arch (16%).....**this variation is quite fine. And the glands function normally.**



Notes on the previous slide .

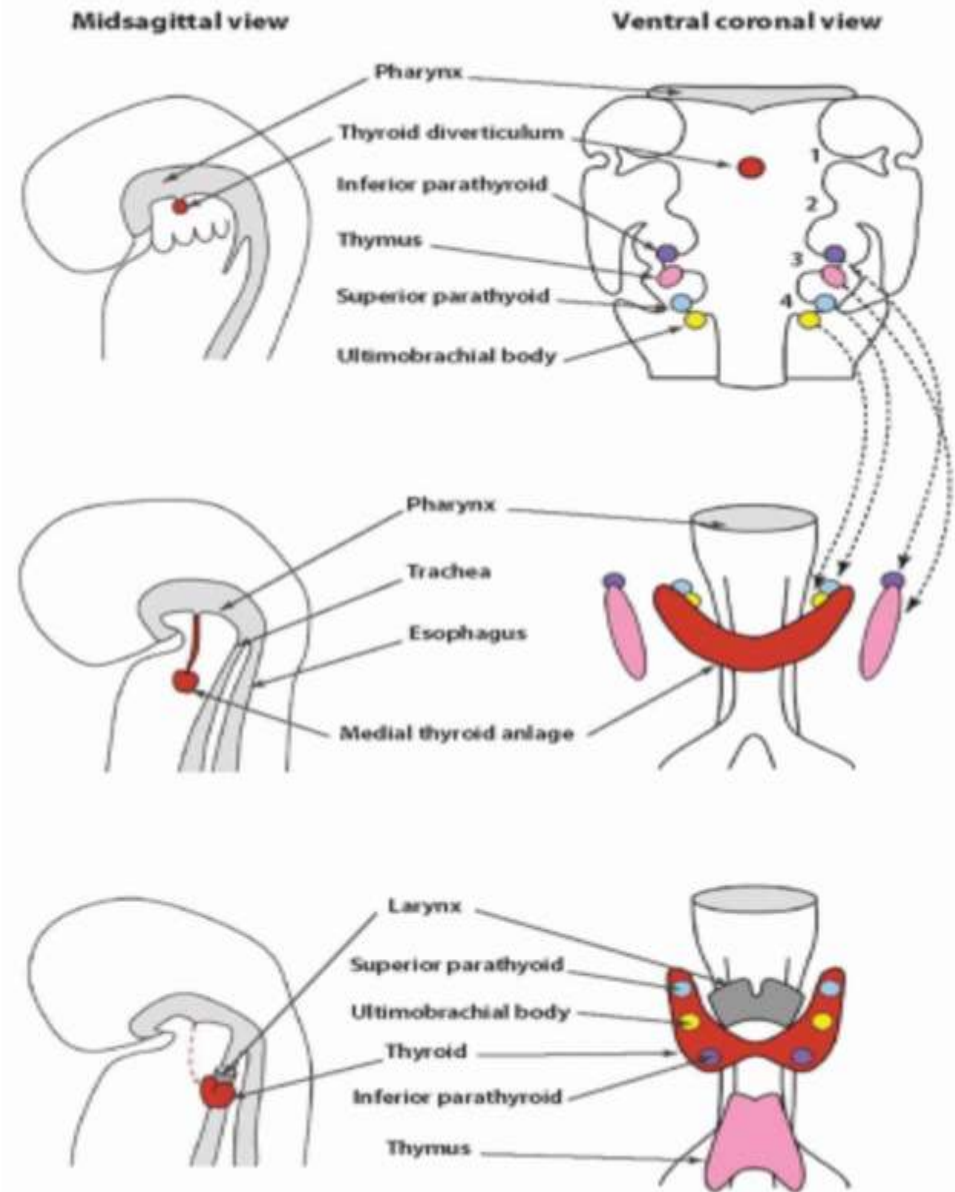
- Regardless their location , the inferior parathyroid glands are still functioning as they have calcium sensitive cells that detects the levels of calcium ,so when it goes down , the gland will release PTH. Also , since they are endocrine glands , they have a direct relation with blood stream so the location will not actually have that massive effect on their function as if they were exocrine glands .

Embryology

-Around 20 days of gestation , the thyroid diverticulum starts to descend until it becomes between C5 and T1

-superior and inferior parathyroid glands start developing during 4th-5th week of gestation...notice that the inferior parathyroid is closely related to the thymus and they descend together and separate at some point so the inferior parathyroid gets into the thyroid and the thymus continues its way down to the mediastinum, that is why the inferior parathyroid might be in the thymus.

-the superior parathyroid is close to the ultimobranchial body(which gives parafollicular cells), they descend down and at some level , they get incorporated with the descending parathyroid gland .



Structure

Chief cells:

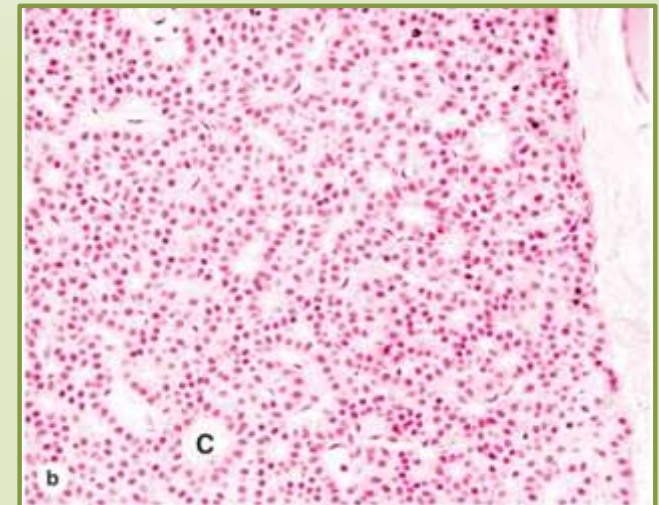
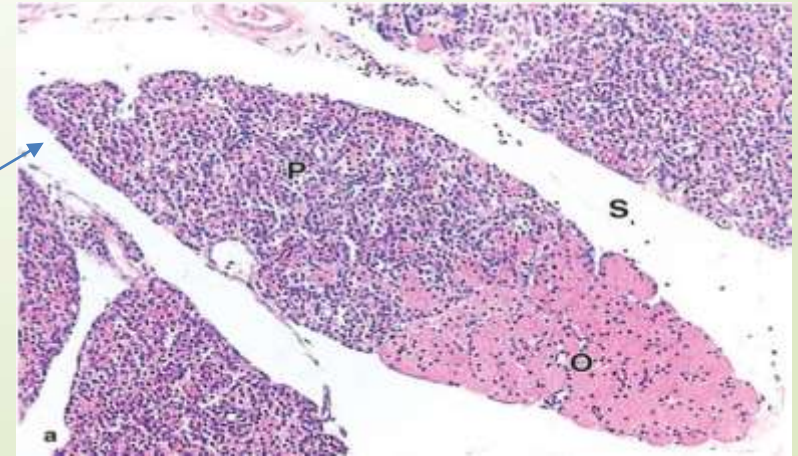
- Manage the secretion of parathyroid hormone (**PTH**).
- Prominent Golgi apparatus and a developed endoplasmic reticulum (synthesis and secretion of the hormone)
- Smaller than the oxyphil cells, they are more abundant.
- Calcium sensitive receptors

Oxyphil cells:

The purpose of these cells is not entirely understood.

Larger than the chief cells and seem to increase in number with age.

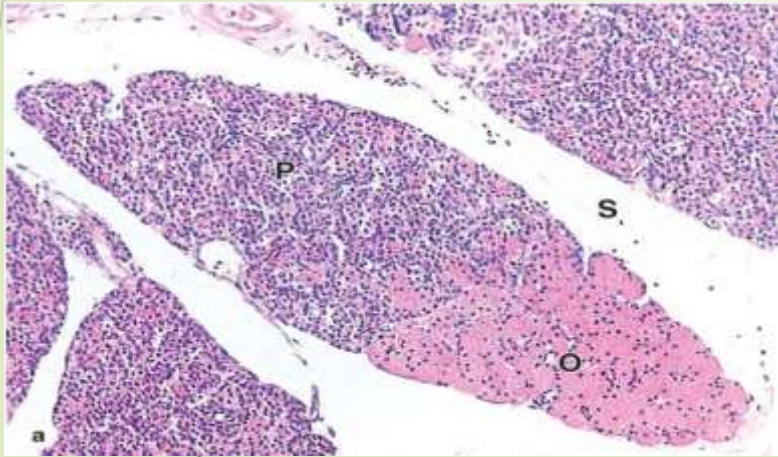
Parathyroid gland has a capsule around it (very small though) , which sends septa into the gland to divide it into lobes and lobules



(a) A small lobe of parathyroid gland, septa (S),

(b) (b) Higher magnification shows that principal cells have round central nuclei and pale-staining cytoplasm

Notes on the previous slide .



- At this level of magnification , we can see contrast in staining . This indicates that the gland is populated by two different types of cells.
- The upper part is basophilic , this indicates that the cells are small in size so their nuclei are close to each other (these cells are called chief cells) and they are secretory . Meaning that , they have calcium sensitive receptors that are able to detect calcium levels, maintaining it's concentration by secreting PTH when its level goes down .
- chief cells are the most prominent in the gland.
- zones of chief cells might contain oxyphils and vice versa.

Notes on the previous slide...cont

- In the lower part , the cells are eosinophilic , this indicates their large size and thus, the abundance of cytoplasm ,(these cells are called oxyphils)
- Oxyphils are not detected in newly borns and during the first couple of years , they start to be detected later during the first decade and during puberty, so they are related to sex hormones .
- Oxyphils are non-functional cells ,meaning that we don't know what they do so far...they are still under investigation .
- Note: you might hear about a third type of cell populations in the parathyroid glands, that is , the clear cells(they are more or less chief cells but with no granules)...you will not be asked about them .



Surgical Considerations

Important !

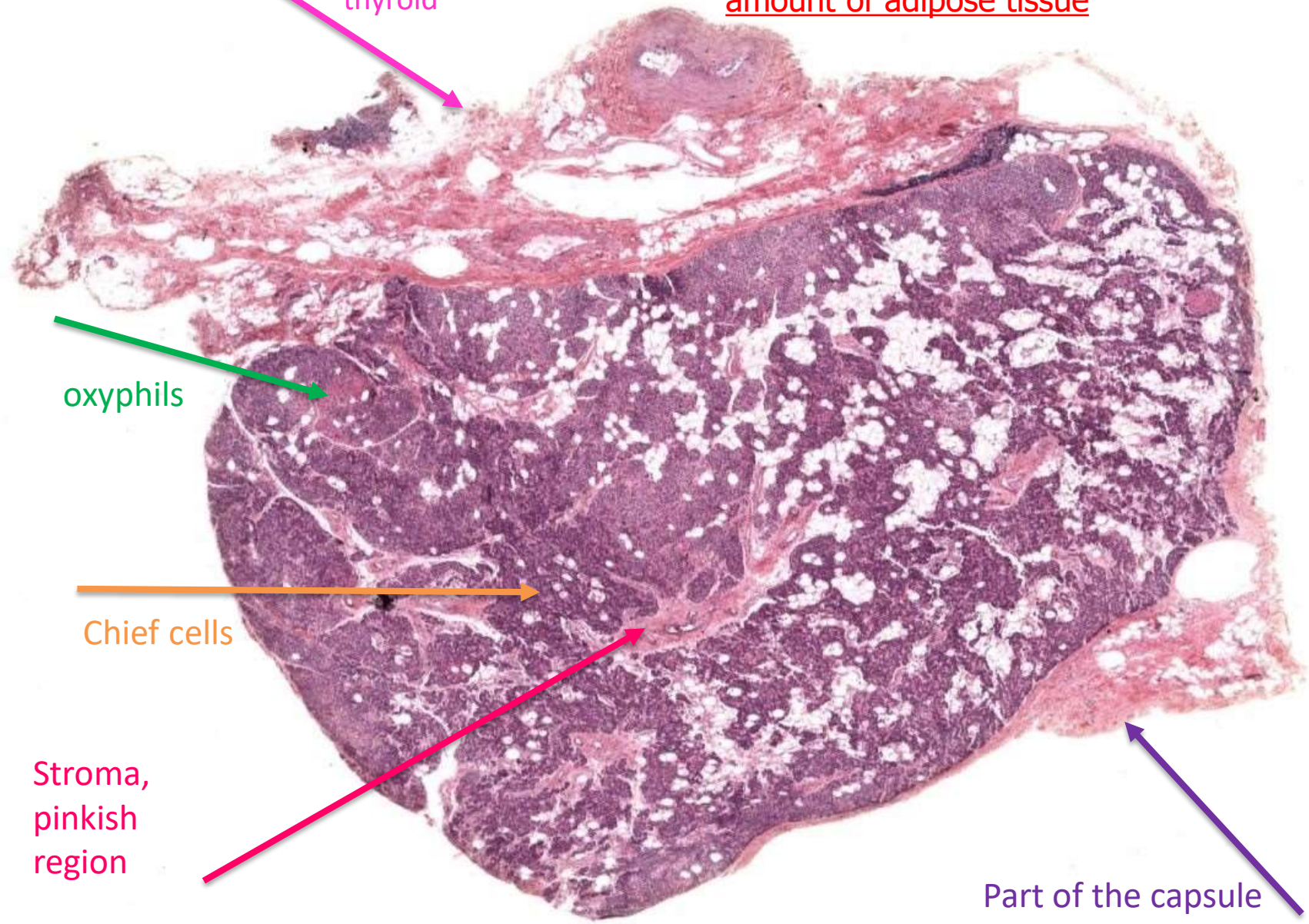
- Have inconsistent locations between individuals and these locations can vary widely.
- Damage to the glands can occur during neck surgery, especially thyroidectomy.
- Preservation of as many parathyroid glands as possible.
- A single parathyroid gland should be sufficient!!!!
- Lifelong calcium and vitamin D supplementation may be required, when?
- Removal of both pairs of the parathyroid gland is extremely uncommon.

Notes on the previous slide .

- If we need to remove the thyroid gland for one reason or another , we have to spare one parathyroid gland at least.However, it depends on the case , if the thyroidectomy is due to cancer , we have to decide as the parathyroid glands might also have cancerous cells .
- In case that all of the parathyroid glands have to be taken out , the patient should take vitamin D and calcium supplementation for their whole life.there is also a recombinant PTH that can be given to the patient.
- can we transplant parathyroid glands ?
Yes , we can almost transplant everything other than neurons (they are very challenging to be transplanted because of the complexity of their synapses).However , it is doable for glandular tissues if the patient and donor are matched.

Note: this gland is for a person who is not too old neither too young but in between , see the amount of adipose tissue

Where it is attached to the thyroid

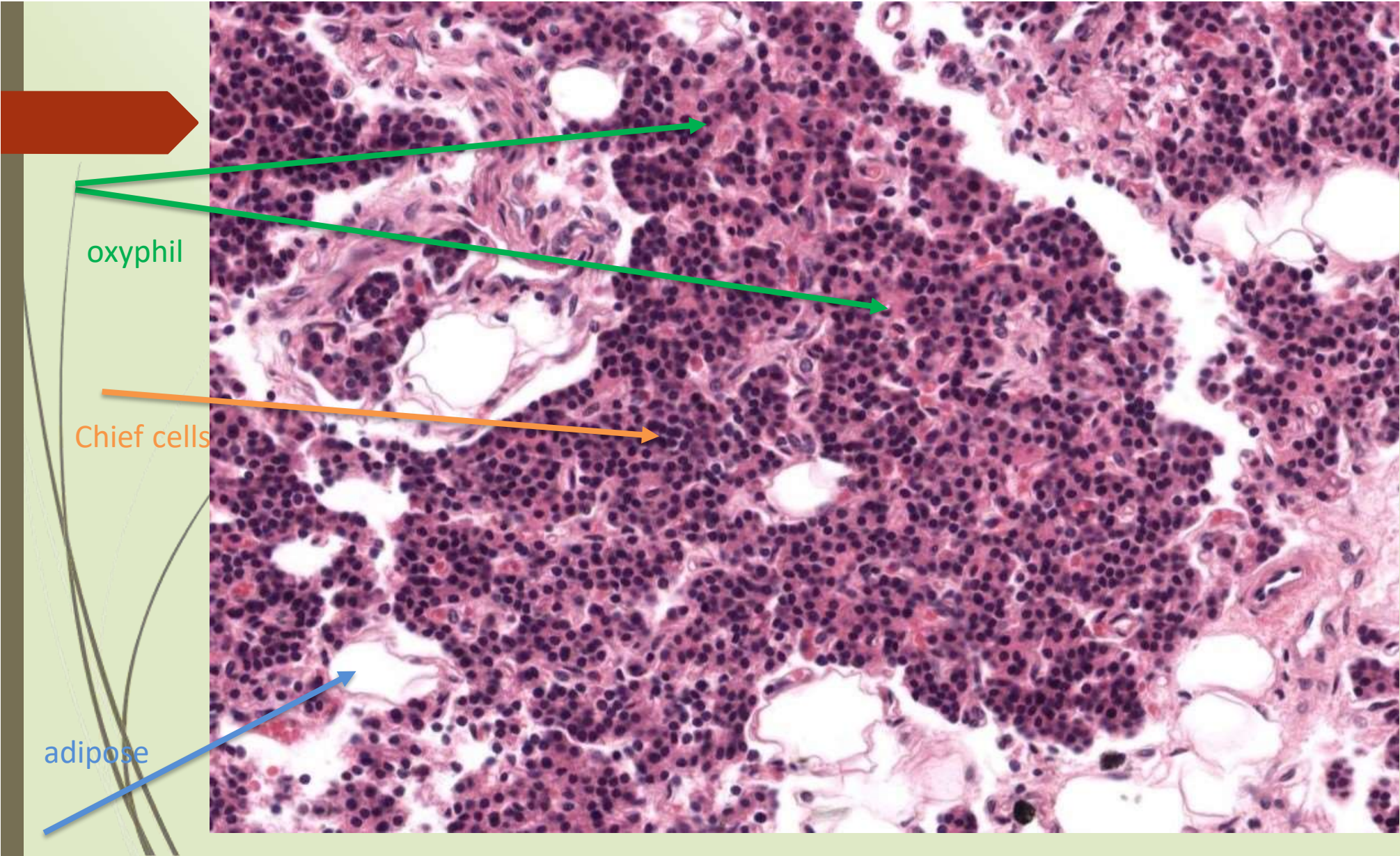


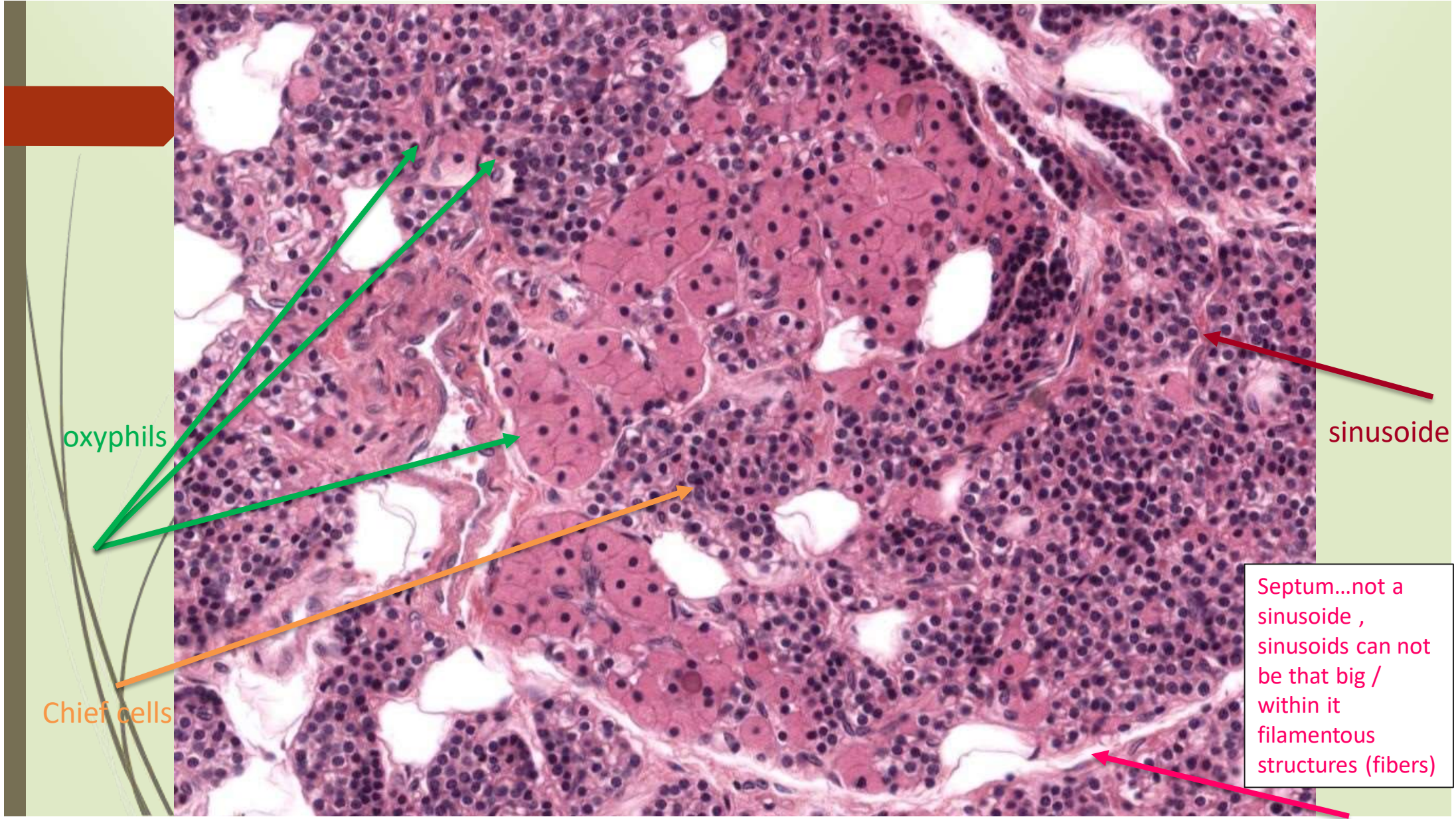
oxyphils

Chief cells

Stroma,
pinkish
region

Part of the capsule





oxyphils

Chief cells

sinusoide

Septum...not a sinusoide ,
sinusoids can not be that big /
within it filamentous structures (fibers)