Open Lab Endocrine- blood Review

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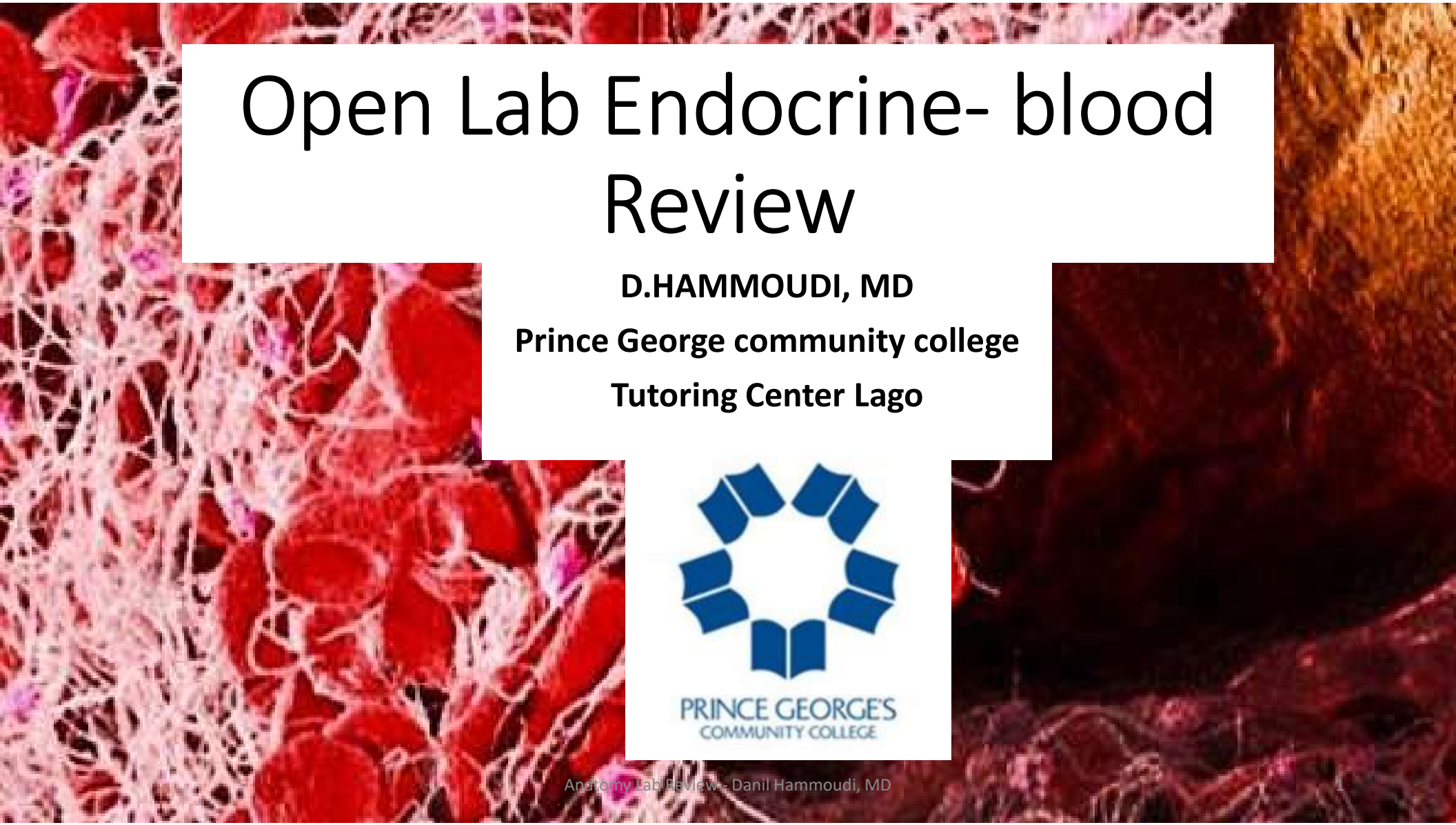
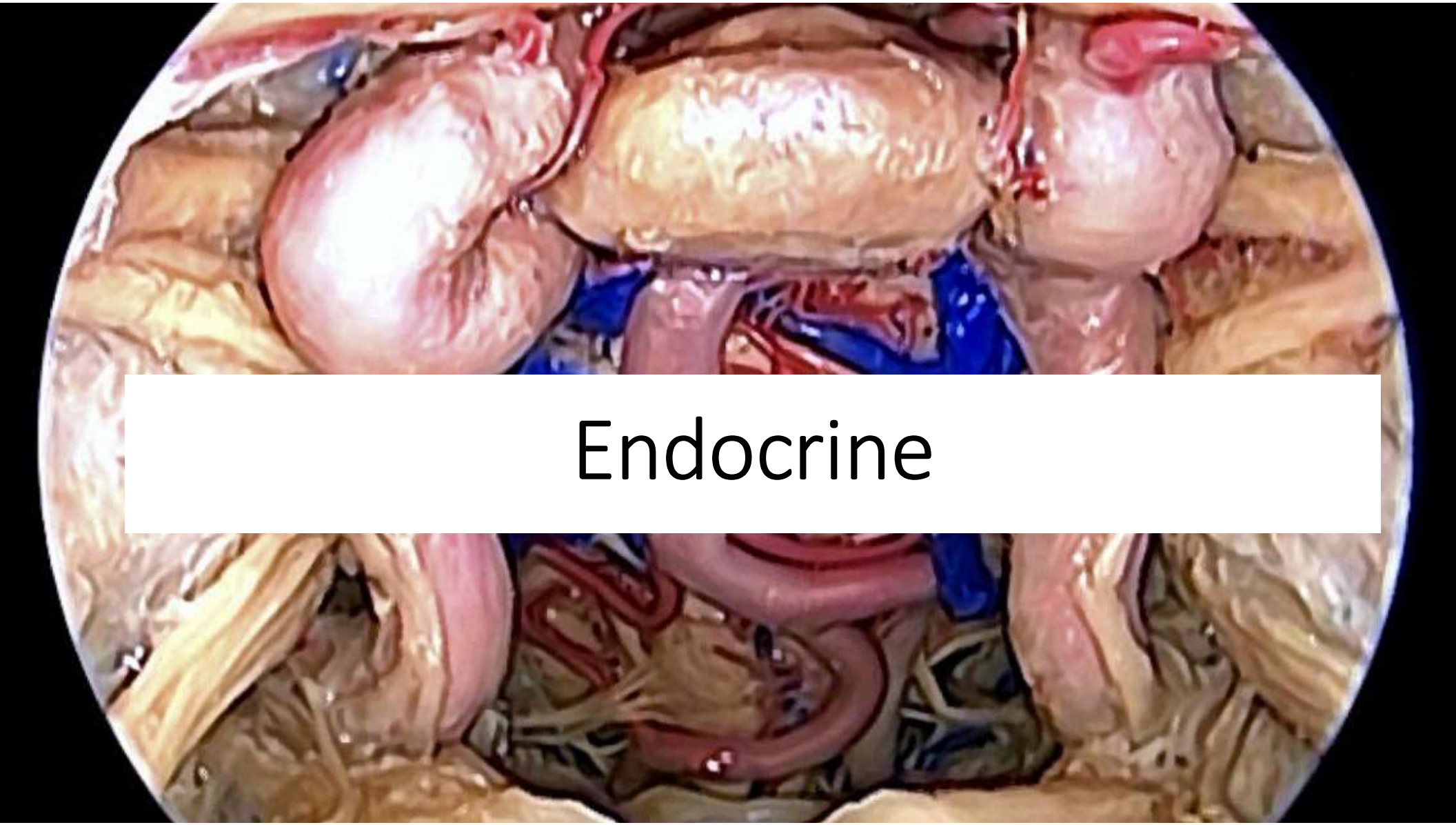




Endocrine

Which glands serve dual purpose? (more than one answer)

a. gonads
b. pancreas
c. thalamus
d. thymus
e. hypothalamus

a, b, d and e; gonads, pancreas, thymus and hypothalamus

How do hormones reach their target cells?

-via bloodstream; bind to specific cell (with help from receptor molecules on target cell) (lock and key)
-With humoral, hormonal or neural stimulus

What are the 3 types of stimuli that regulate secretion from endocrine cells?

a. positive, neutral and negative stimulus

b. neuronal, steroidal and targeted stimulus

c. humoral, neural and hormonal stimulus

c. humoral, neural and hormonal stimulus

What hormones the kidneys produce?

What hormones the kidneys produce?
Erythropoietin, Thrombopoeitin

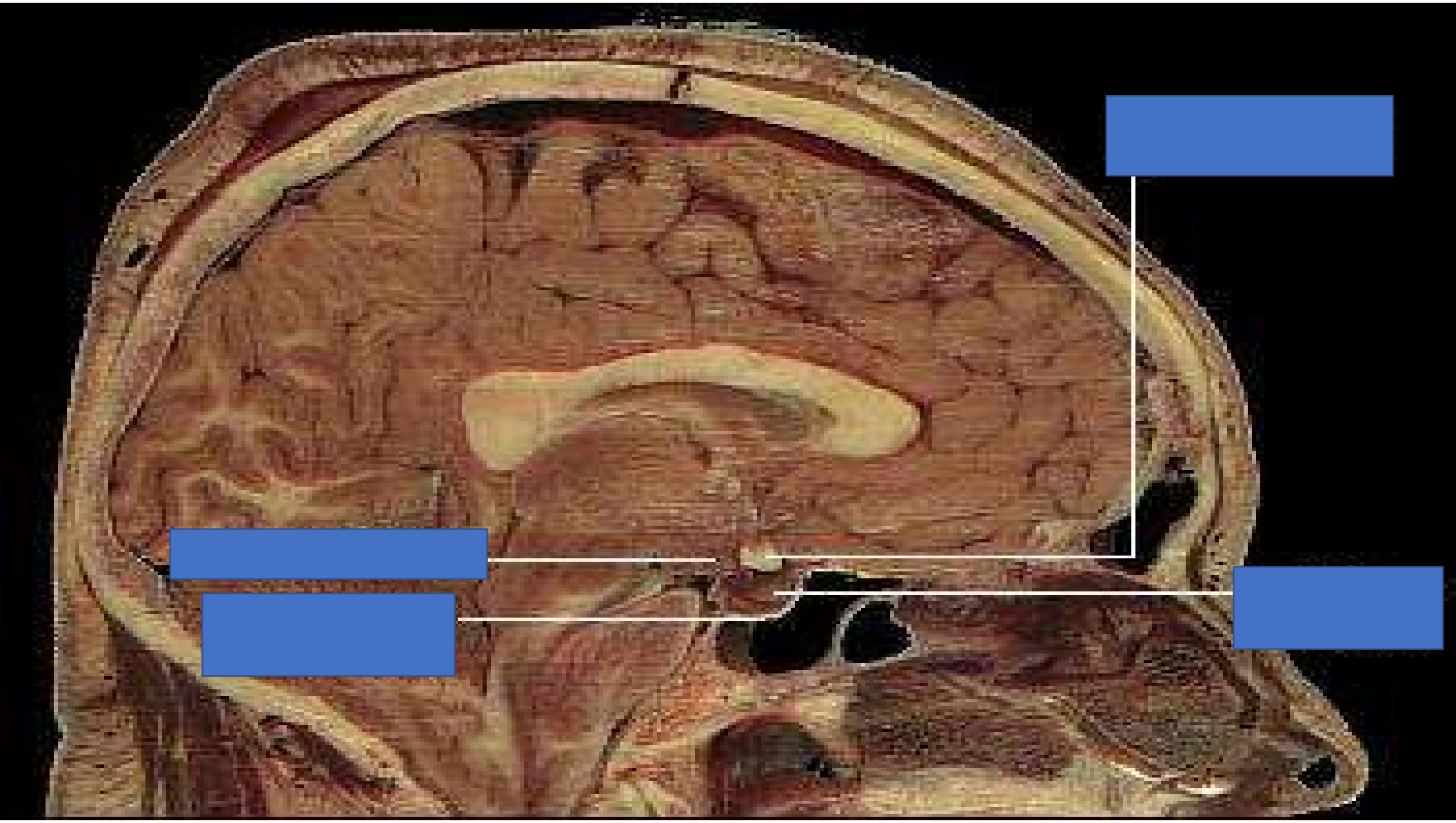
Categorize each of the following as acidophilic, basophilic, or chromophobic. What hormone does each cell produce?

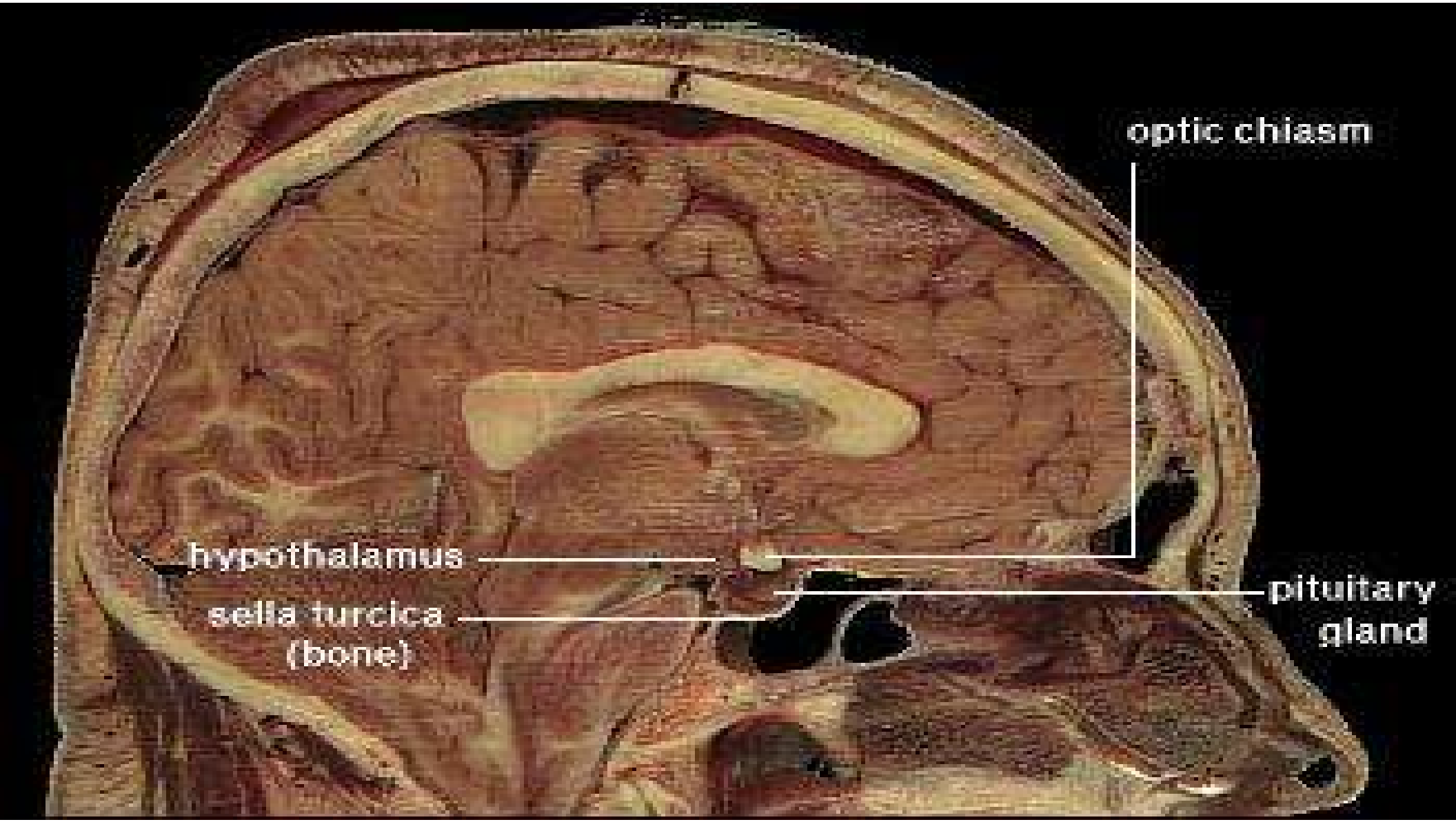
- Thyrotroph
- Corticotroph
- Somatotrophs
- Gonadotroph
- Mammotroph

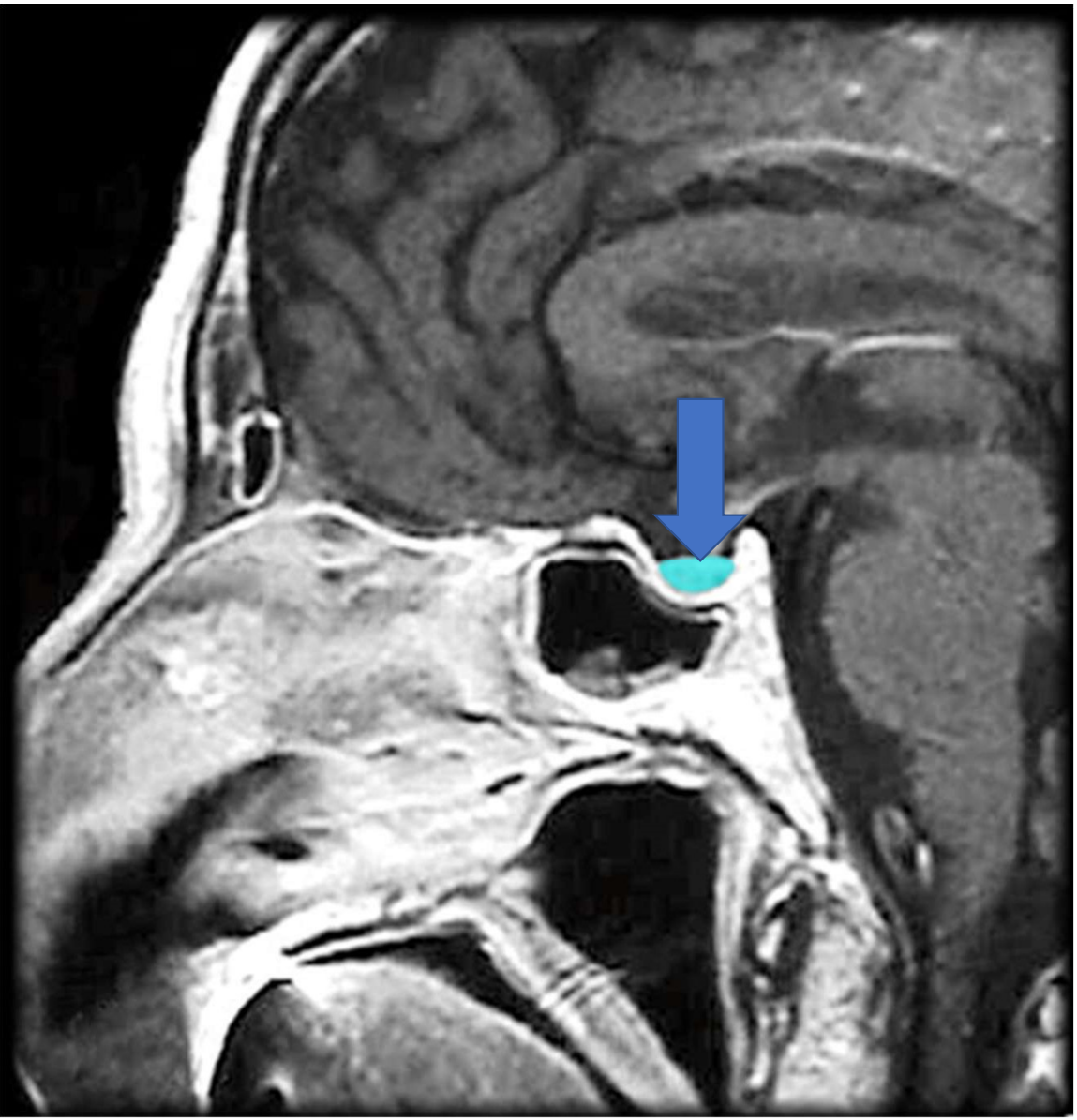
- Thyrothrpoh: basophilic produces TSH
- Corticotroph: basophilic produces ACTH
- Somatotrophs: acidophilic produce GH
- Gonadotrophs: basophilic produce LH and FSH
- Mammotroph: acidophilic produce prolactin.

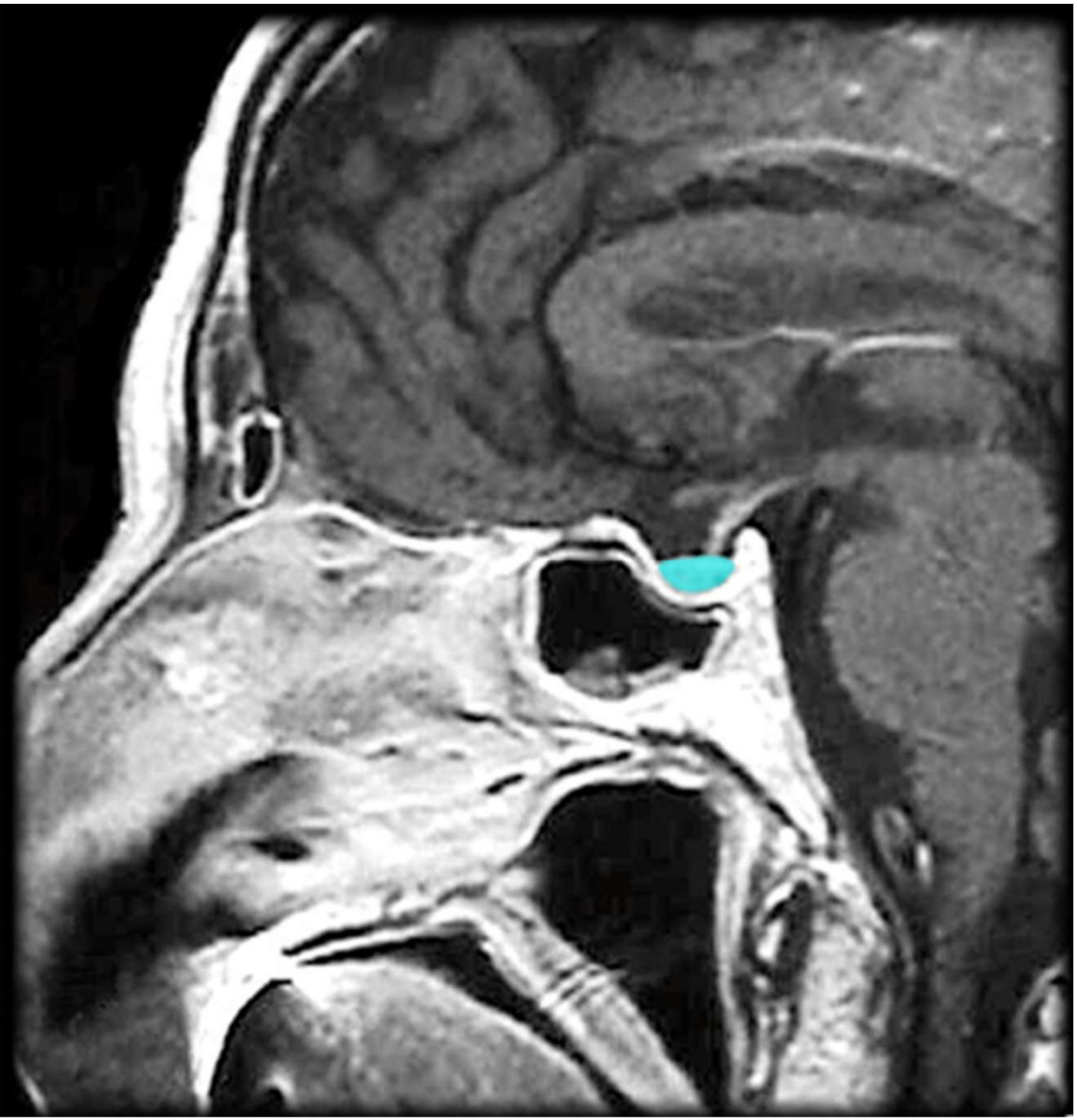
What are three ways that PTH increases the level of serum calcium? Explain, in terms of calcium regulation, why a person can live without a thyroid but not without a parathyroid.

PTH increases bone resorption,
increases kidney reabsorption of calcium and secretion of potassium,
increases calcium absorption from the small intestine via vitamin D.
PTH is essential to life but calcitonin is not – it is the “fine control” for calcium regulation, but not necessary.

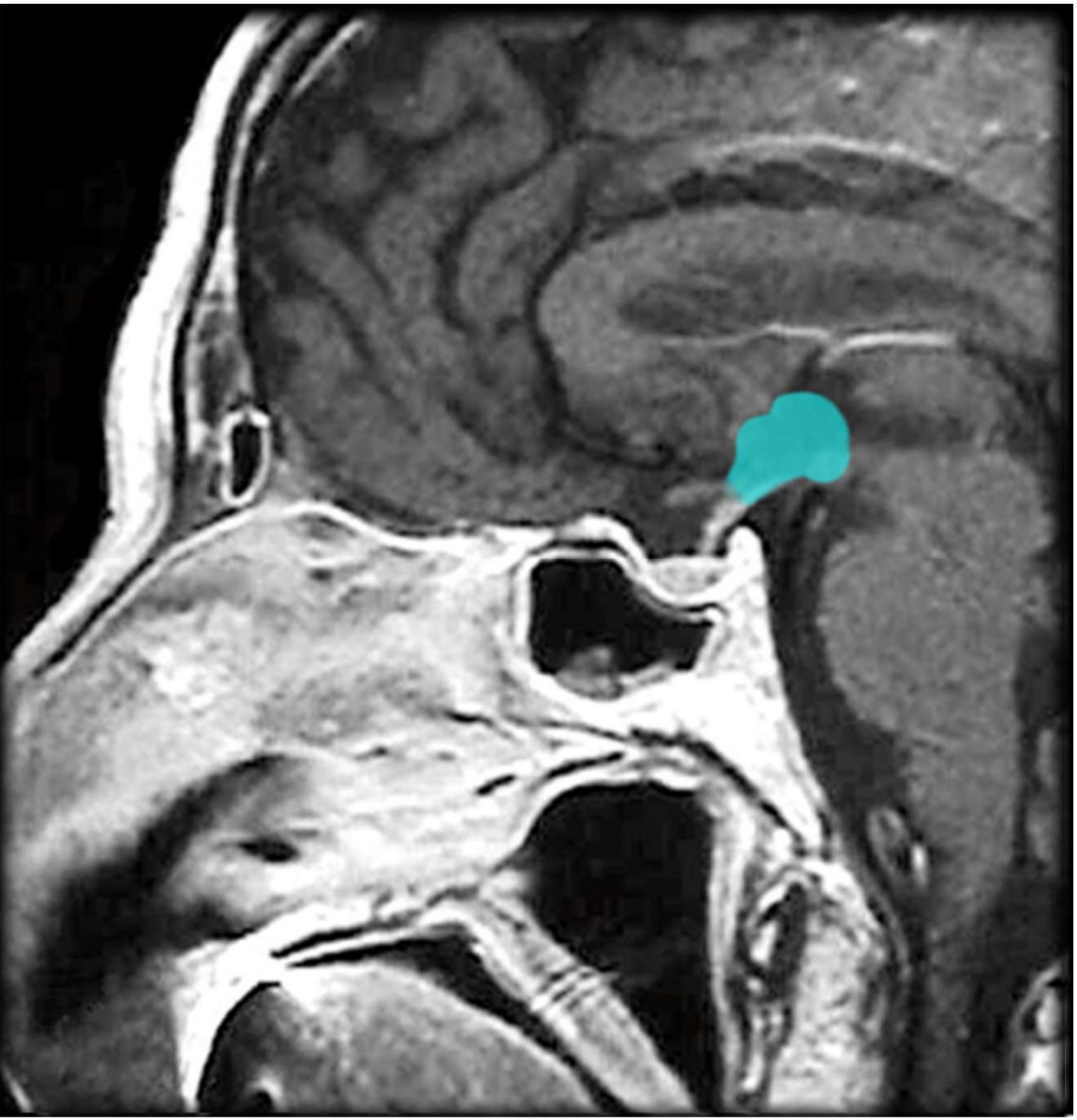


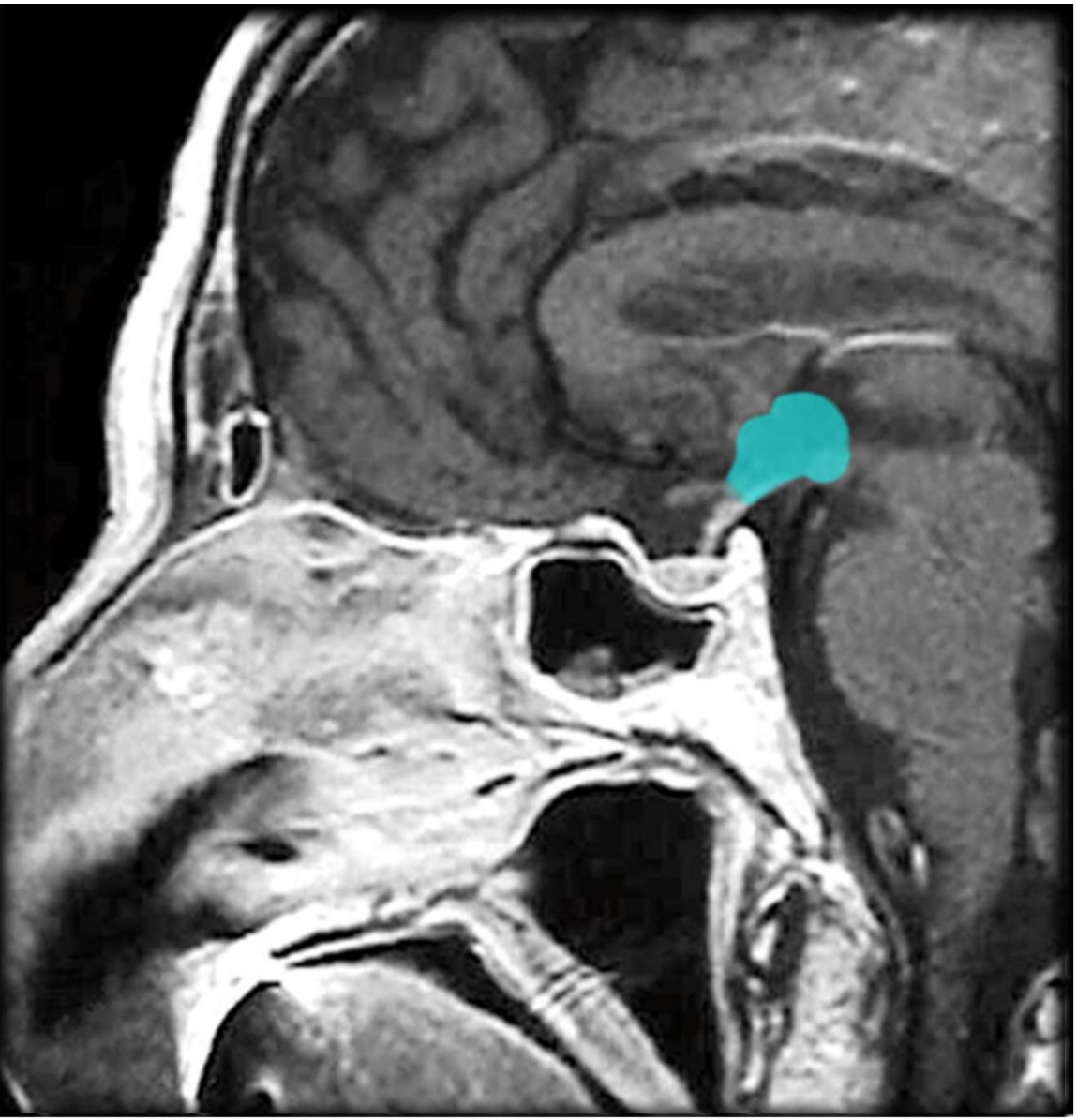

optic chiasm
hypothalamus
sella turcica
(bone)
pituitary
gland



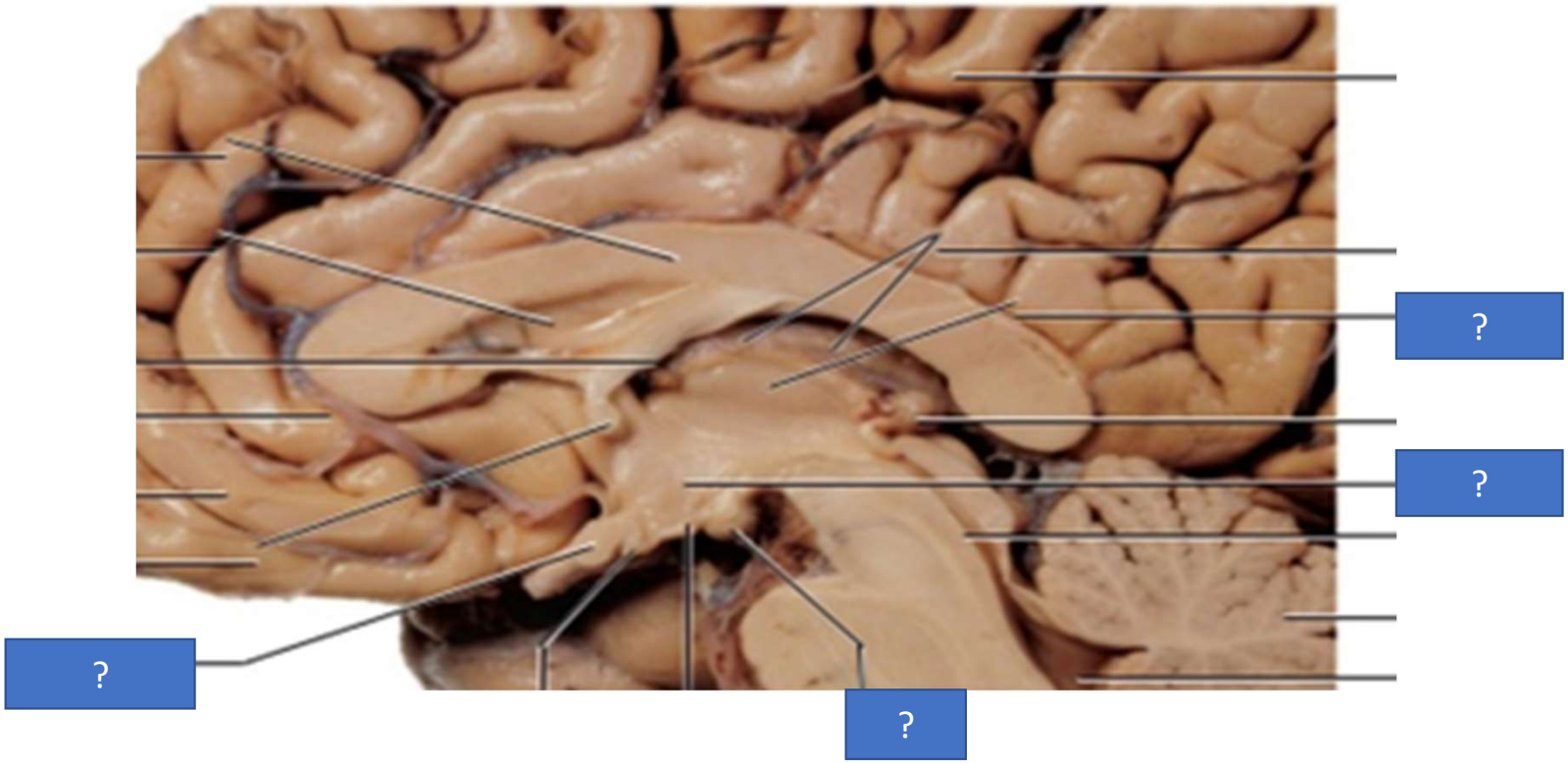


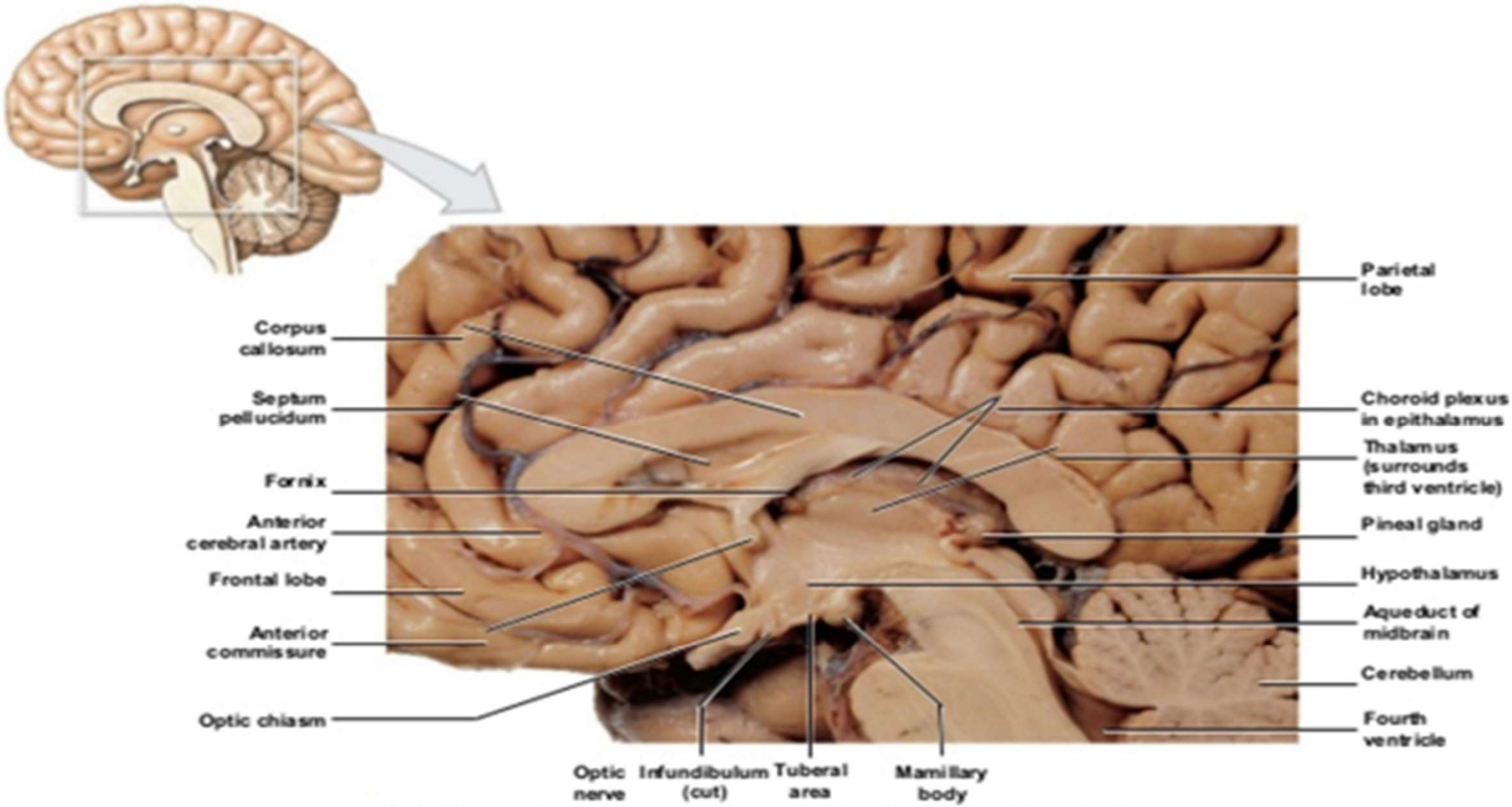
Pituitary gland



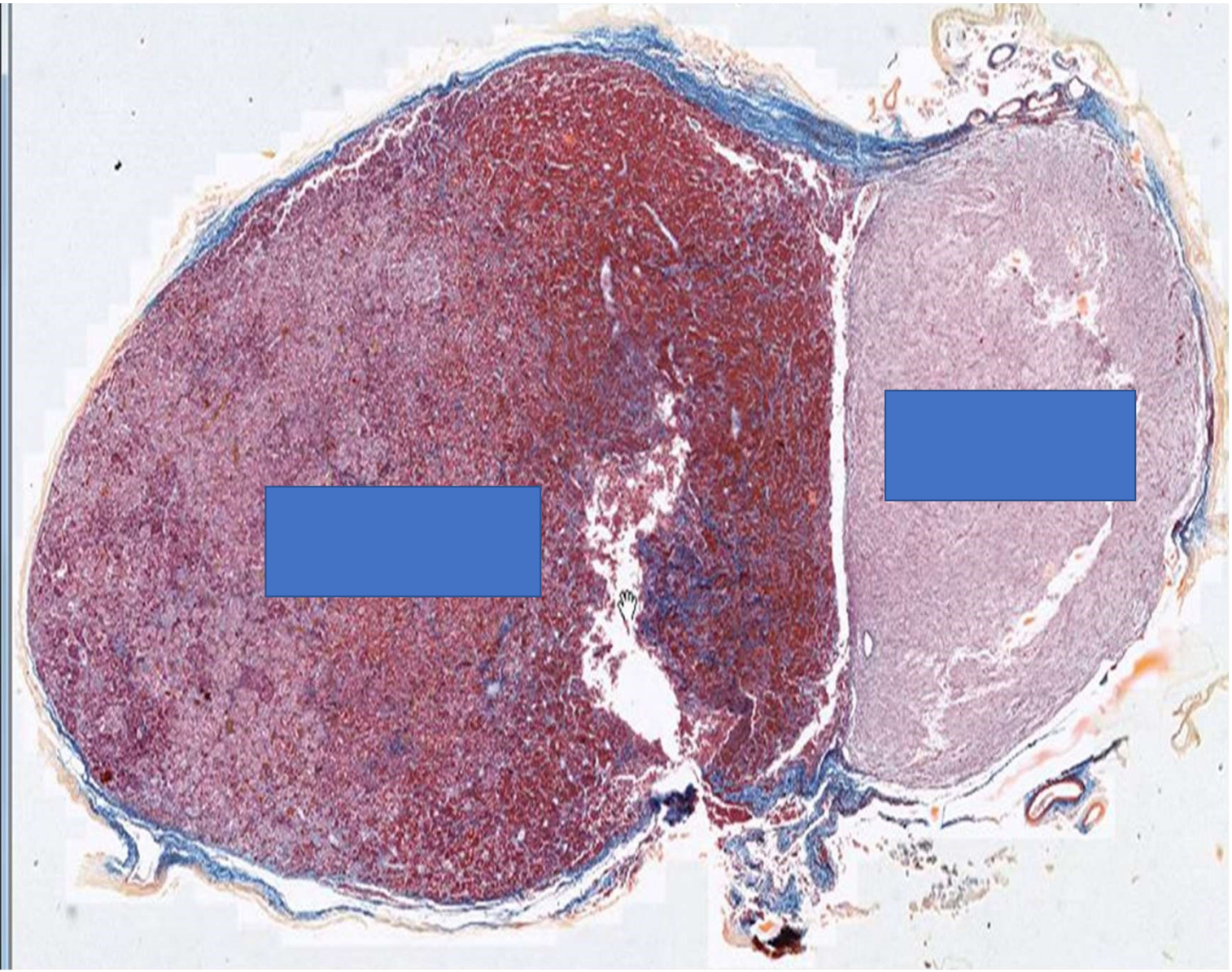


hypothalamus



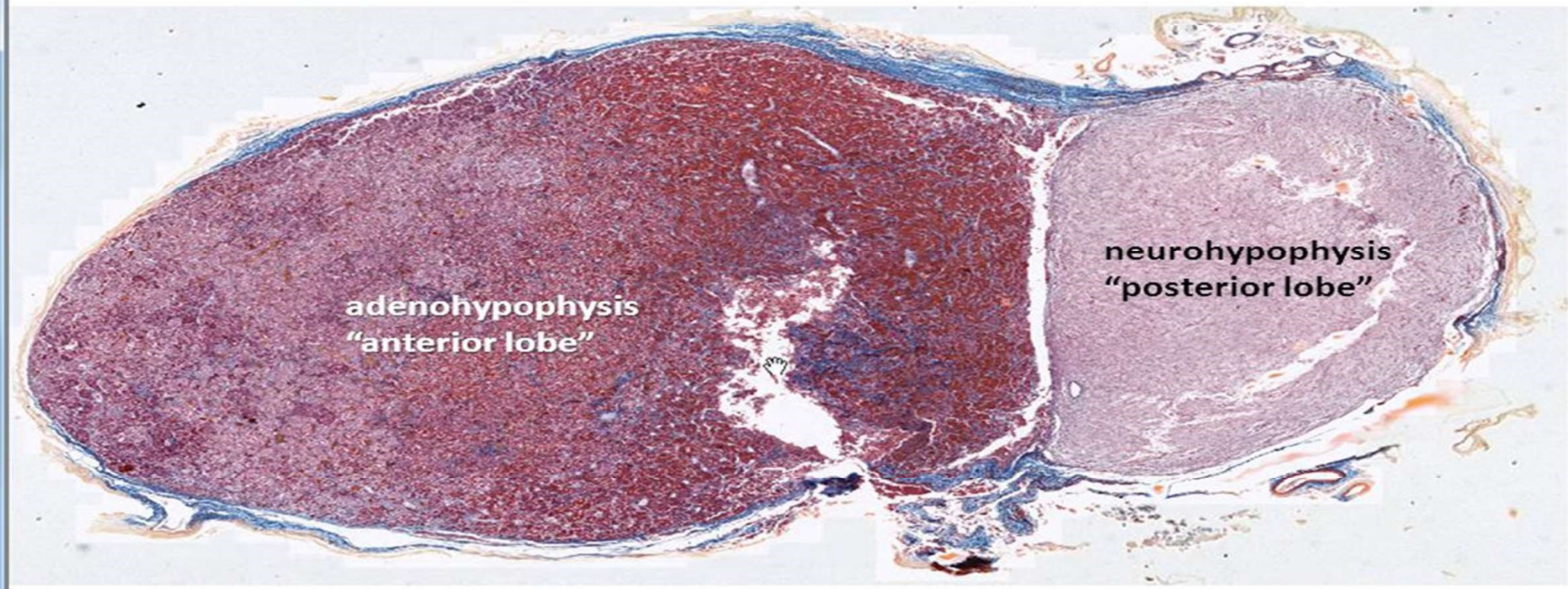


a Midsagittal section through the brain. This view shows the major features of the diencephalon and adjacent portions of the brain stem.

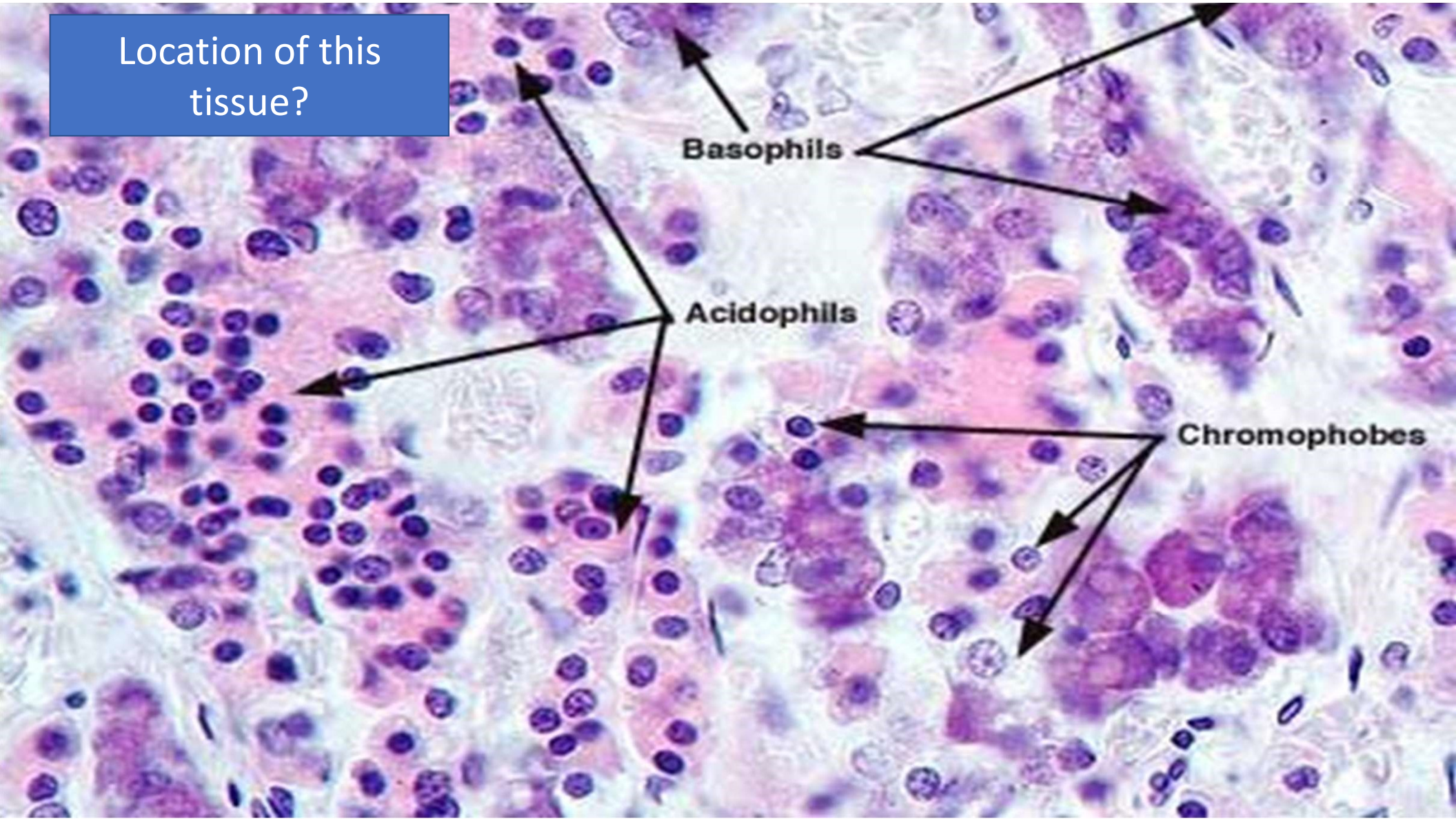


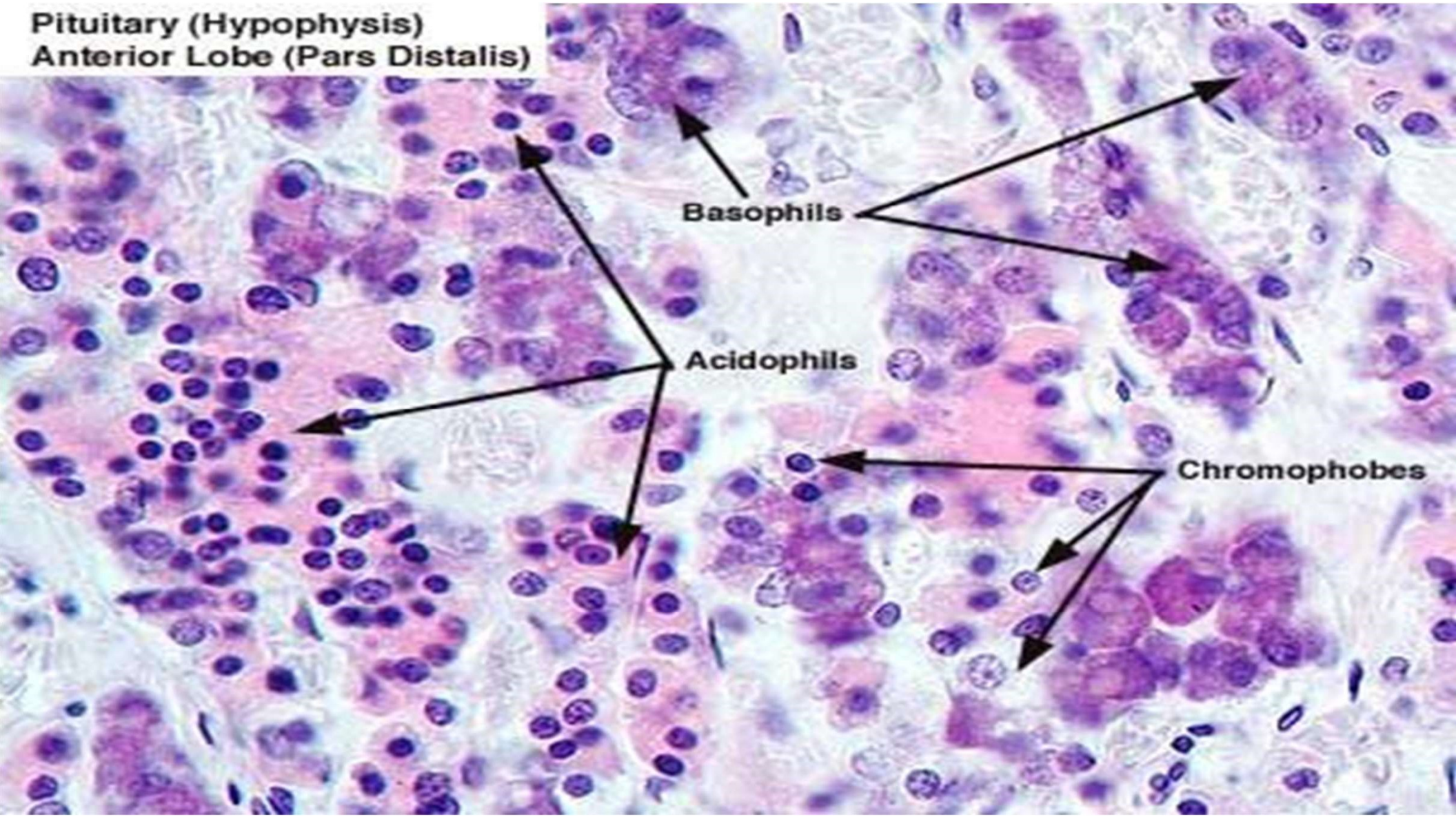
Name this gland and its parts?

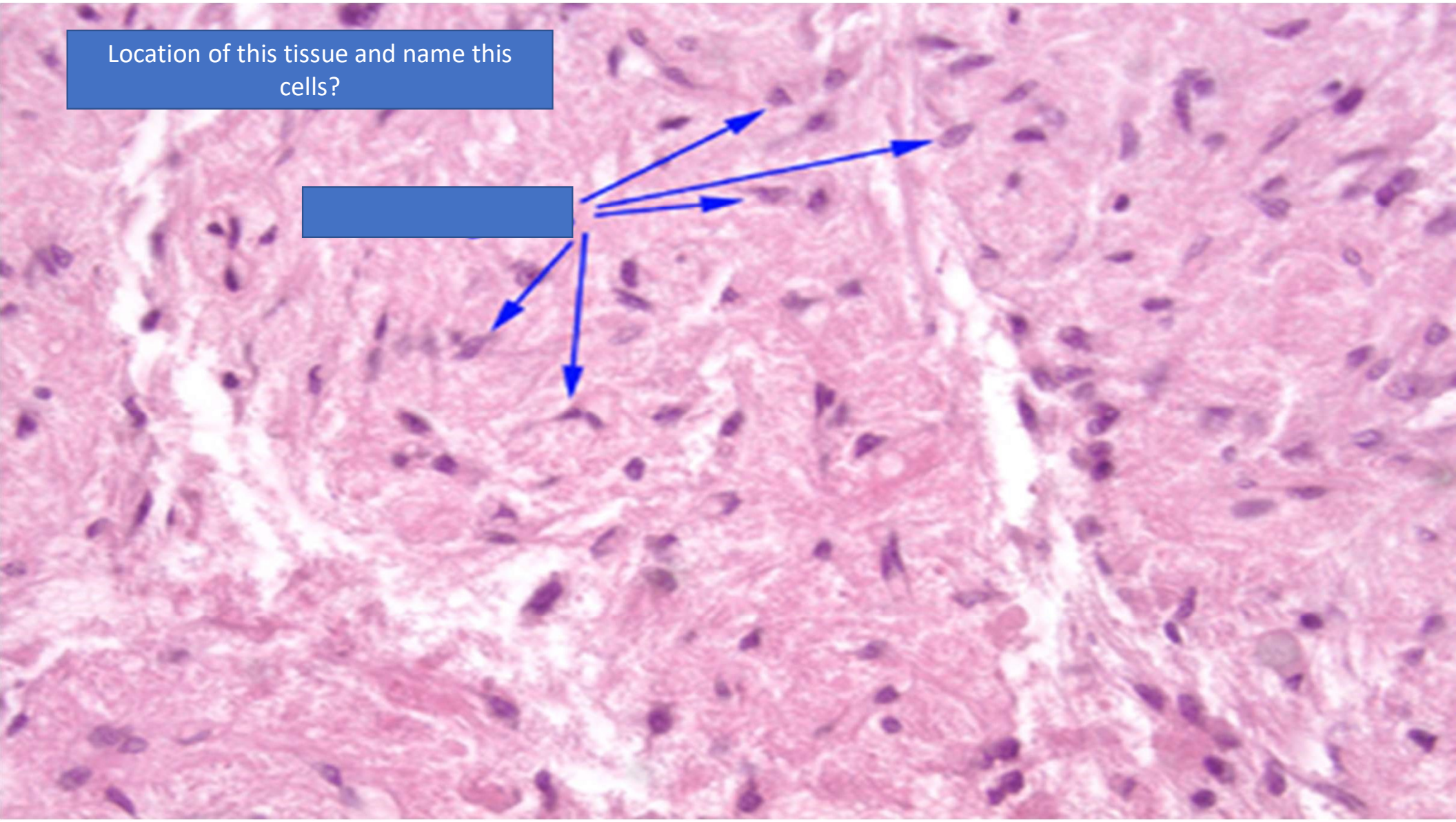
Slide 61: pituitary gland

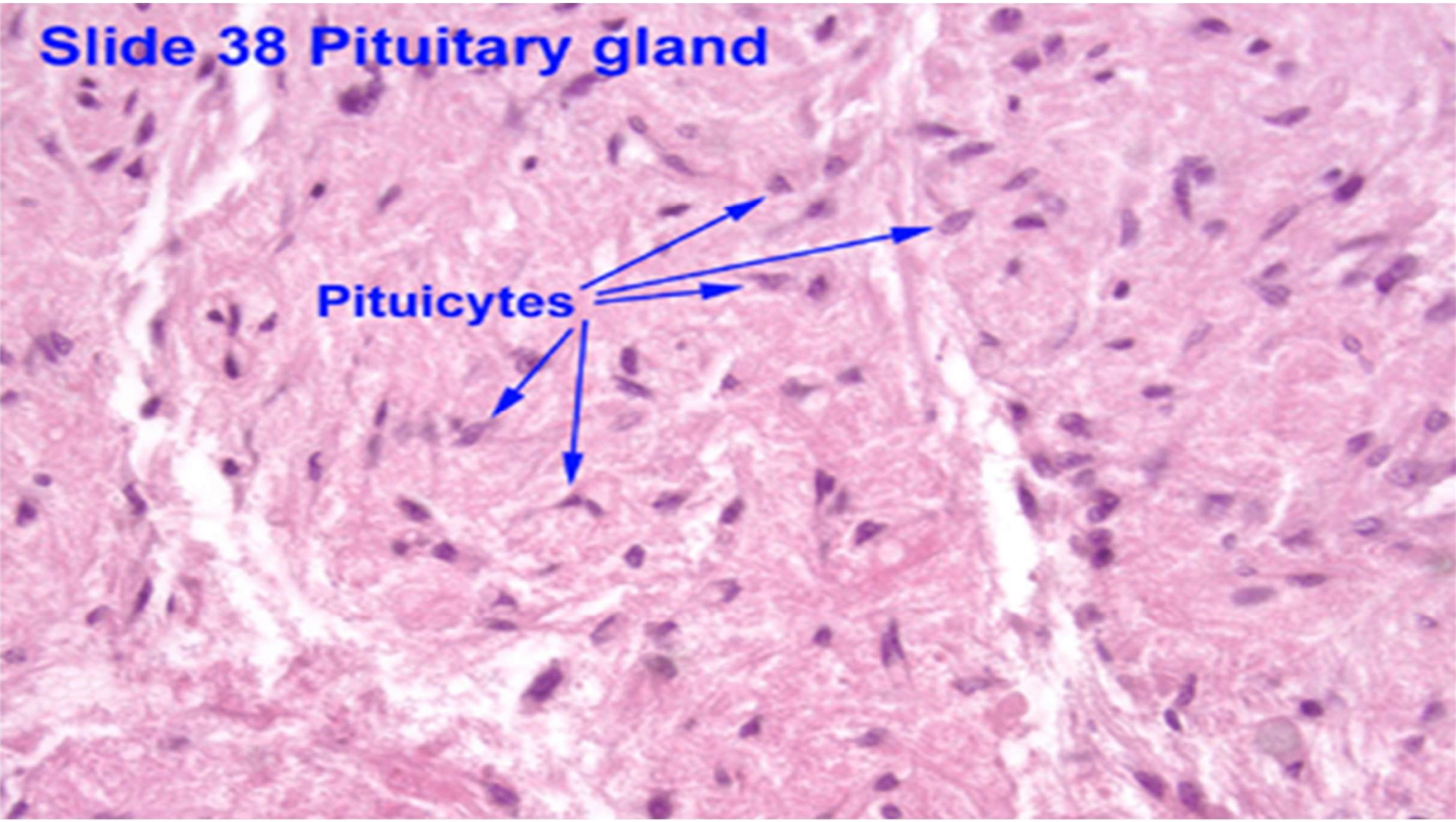


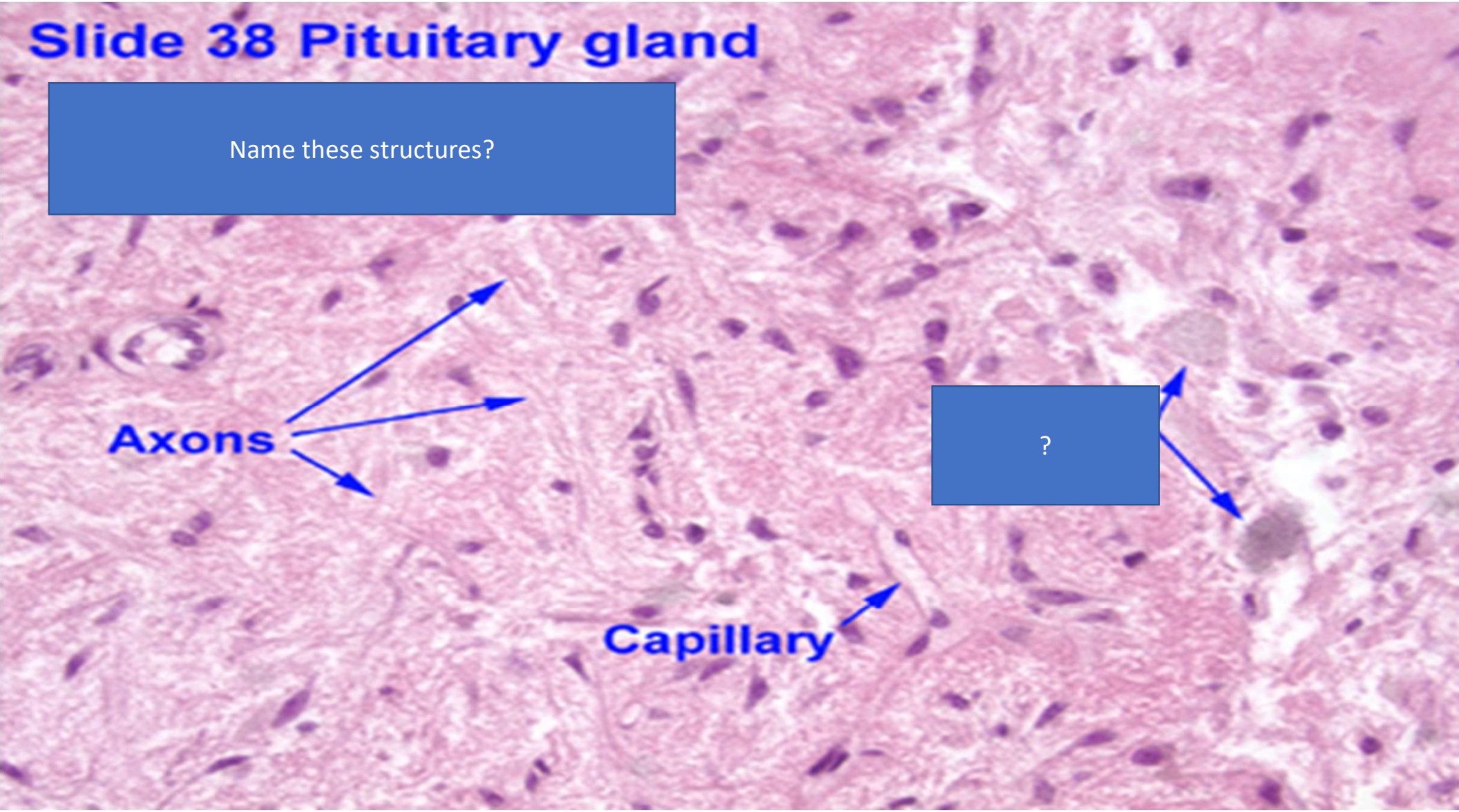
Location of this tissue?

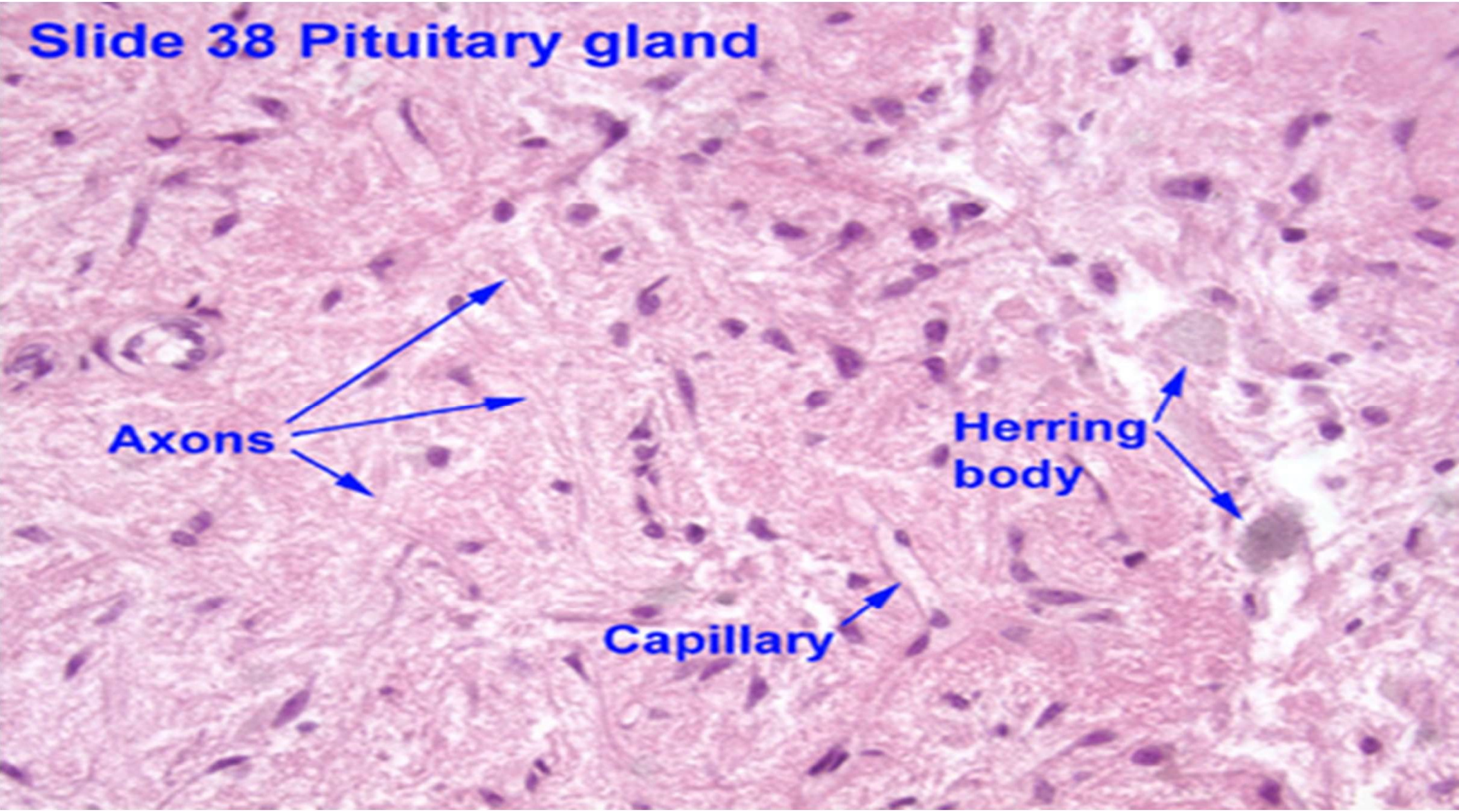


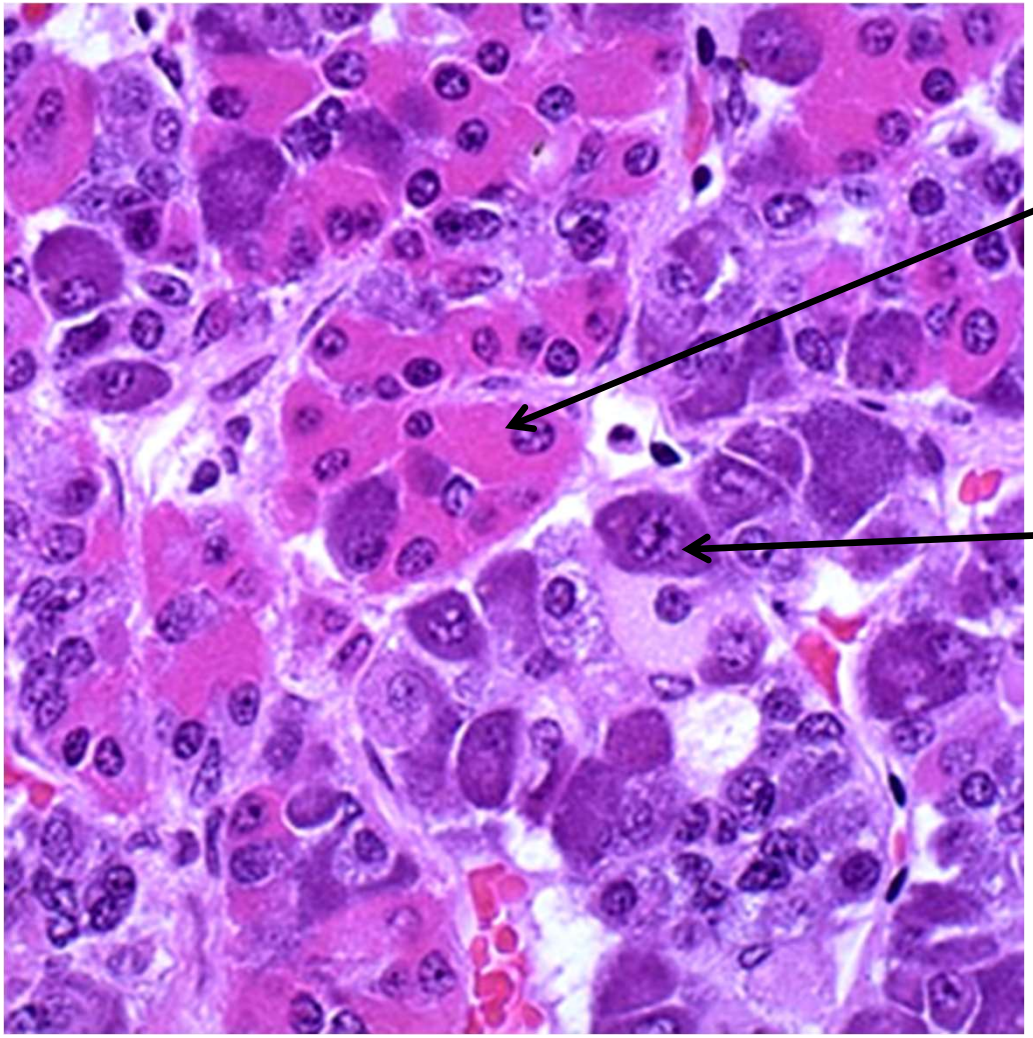

Pituitary (Hypophysis)
Anterior Lobe (Pars Distalis)
Basophils
Acidophils
Chromophobes


Location of this tissue and name this cells?


Slide 38 Pituitary gland
Pituicytes


Slide 38 Pituitary gland
Name these structures?
Axons
?
Capillary


Slide 38 Pituitary gland
Axons
Herring body
Capillary

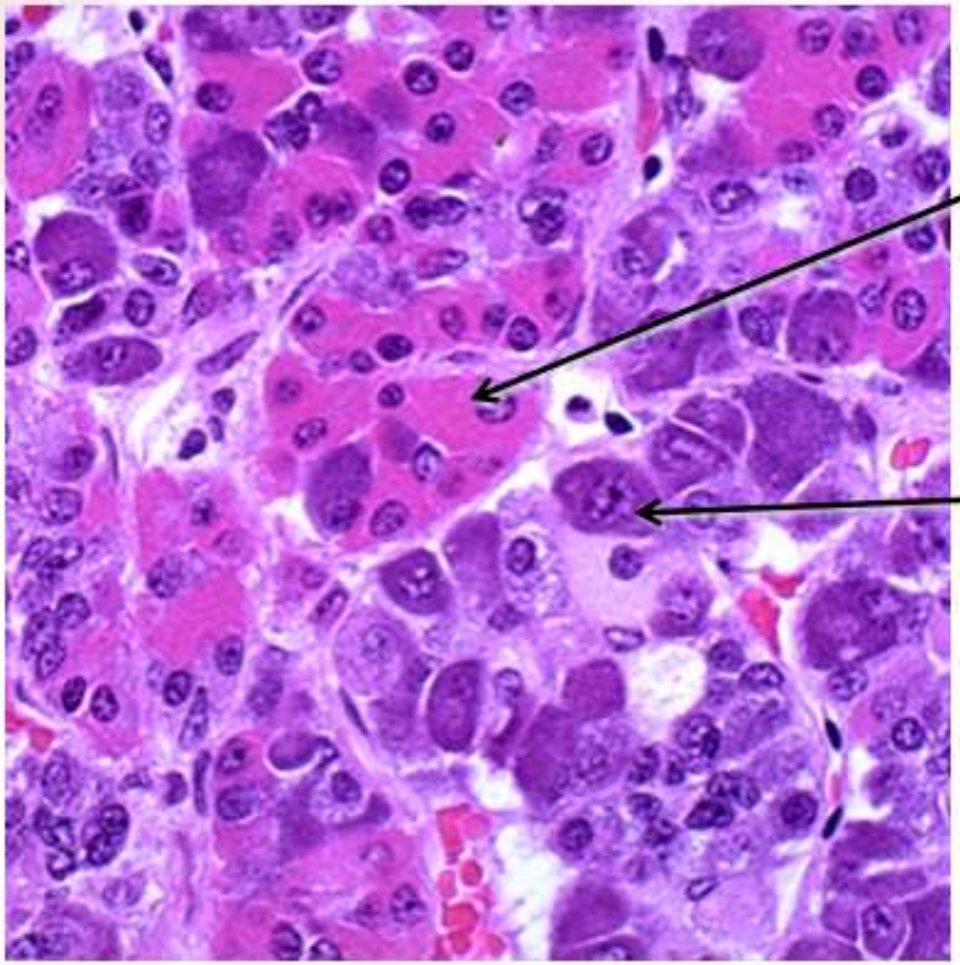


Acidophils

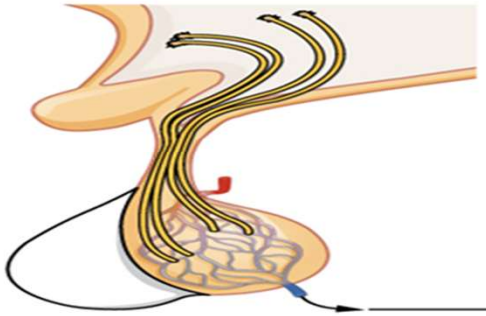
Function ?

Basophils

Function?

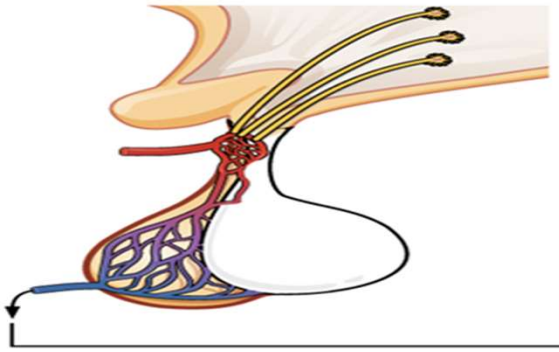

Acidophils
GH
PL
Basophils
FSH
LH
ACTH
TSH

Posterior Pituitary Hormones

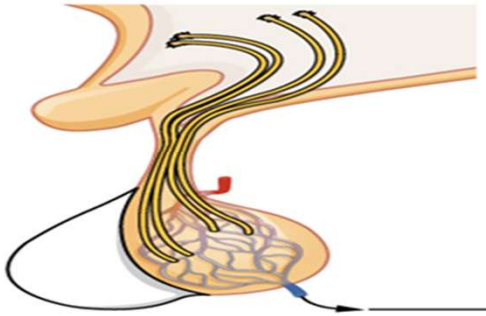


Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
ADH	?	Kidneys, sweat glands, circulatory system	Water balance
–		Female reproductive system	?

Anterior Pituitary Hormones

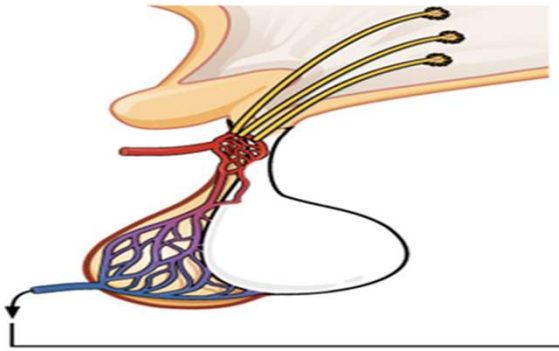


Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
?	LH	Reproductive system	?
	FSH	Reproductive system	
	TSH	Thyroid gland	
	PRL	Mammary glands	
	GH	Liver, bone, muscles	
	ACTH	Adrenal glands	



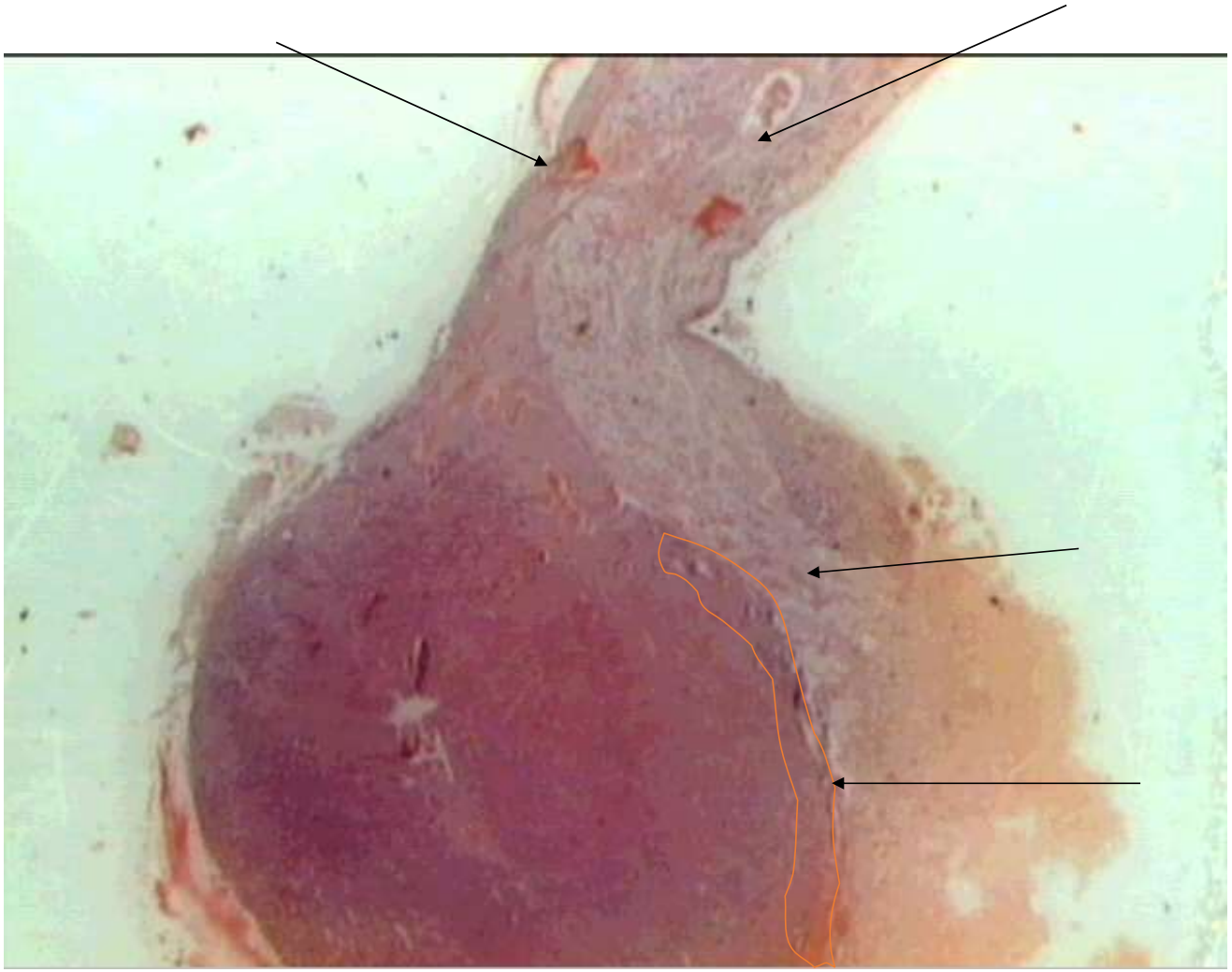
Posterior Pituitary Hormones

Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
ADH	Stores ADH	Kidneys, sweat glands, circulatory system	Water balance
–	OT	Female reproductive system	Triggers uterine contractions during childbirth

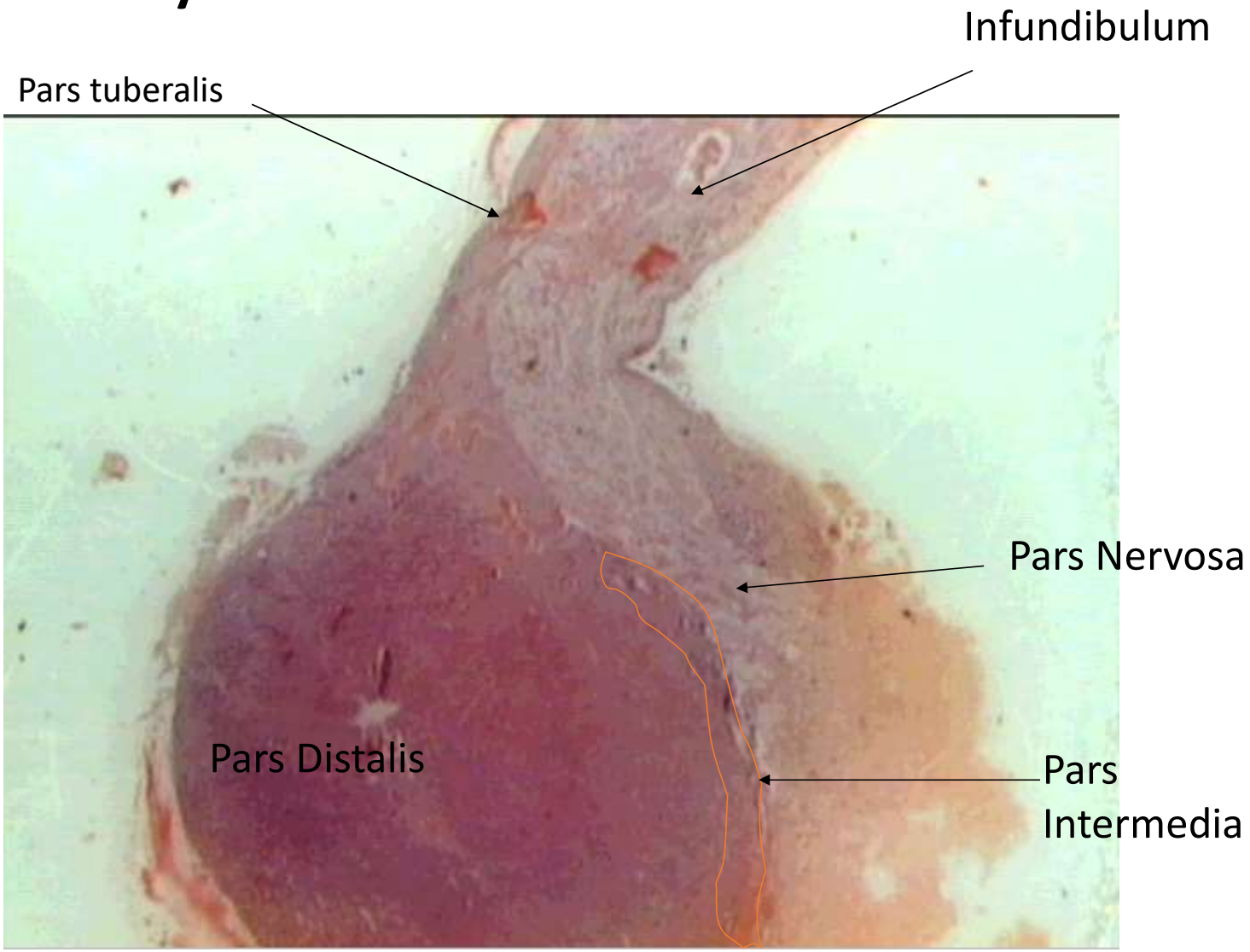


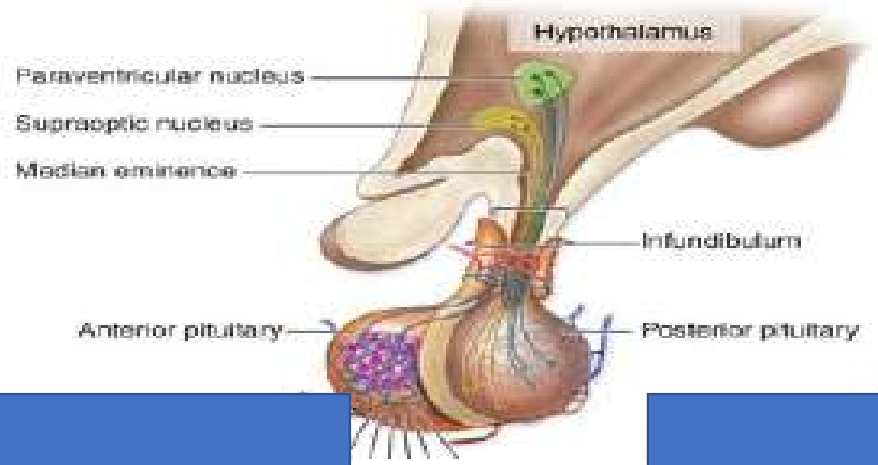
Anterior Pituitary Hormones

Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
GnRH	LH	Reproductive system	Stimulates production of sex hormones by gonads
GnRH	FSH	Reproductive system	Stimulates production of sperm and eggs
TRH	TSH	Thyroid gland	Stimulates the release of thyroid hormone (TH). TH regulates metabolism.
PRH (inhibited by PIH)	PRL	Mammary glands	Promotes milk production
GHRH (inhibited by GHIH)	GH	Liver, bone, muscles	Induces targets to produce insulin-like growth factors (IGF). IGFs stimulate body growth and a higher metabolic rate.
CRH	ACTH	Adrenal glands	Induces targets to produce glucocorticoids, which regulate metabolism and the stress response



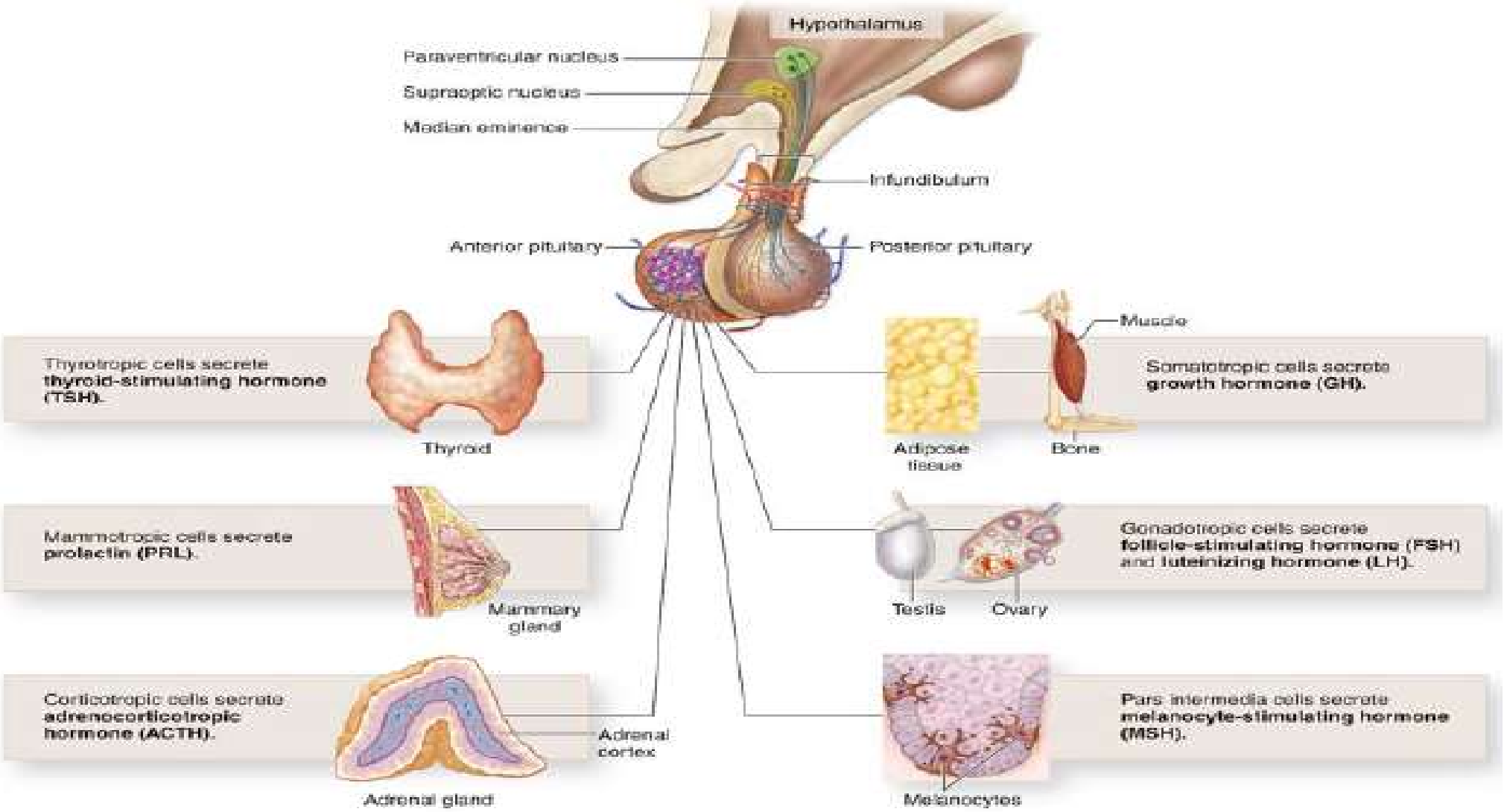
Pituitary Gland

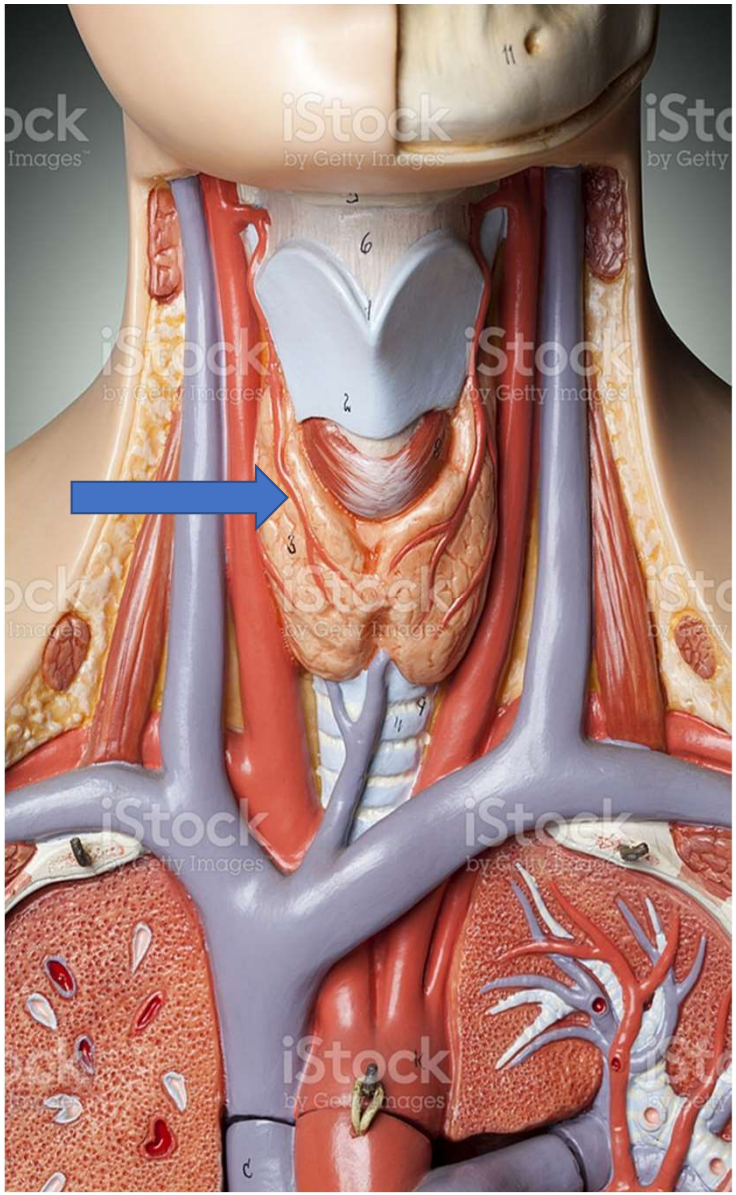




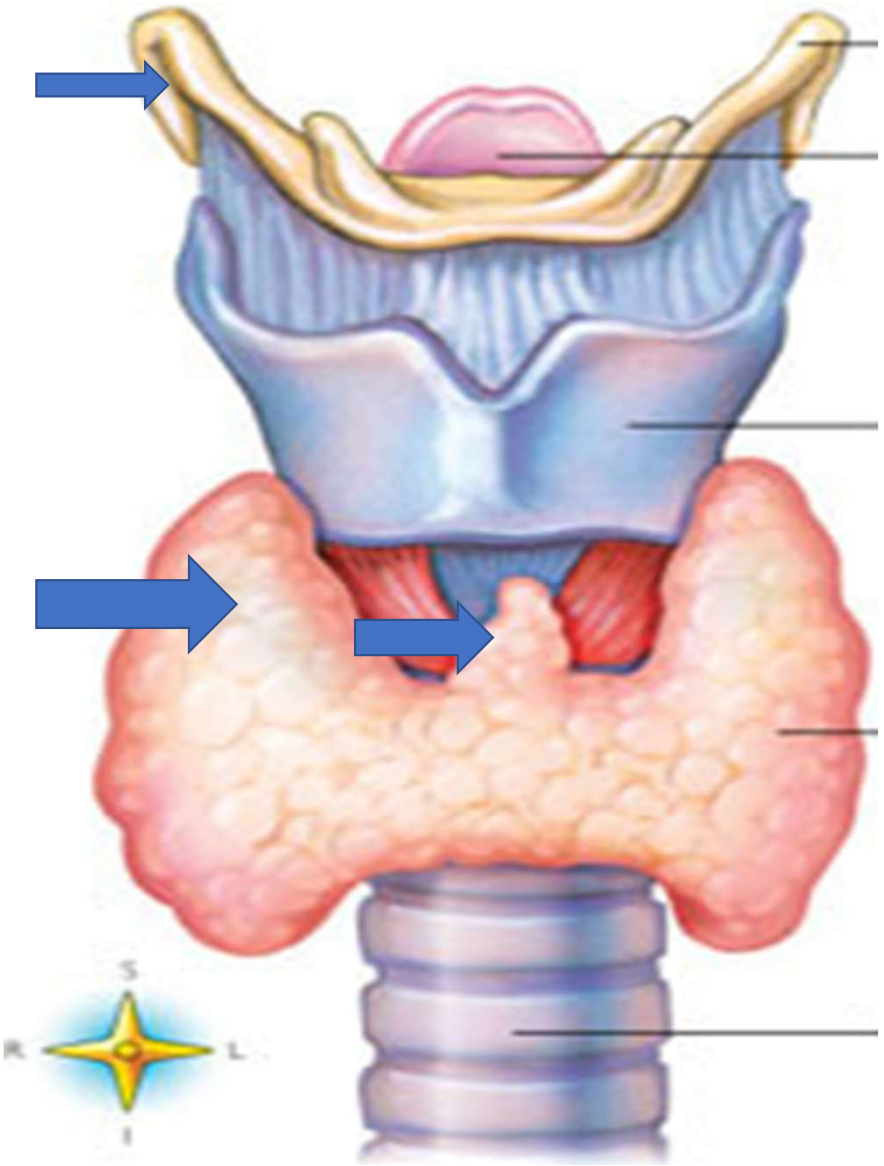
Function 3

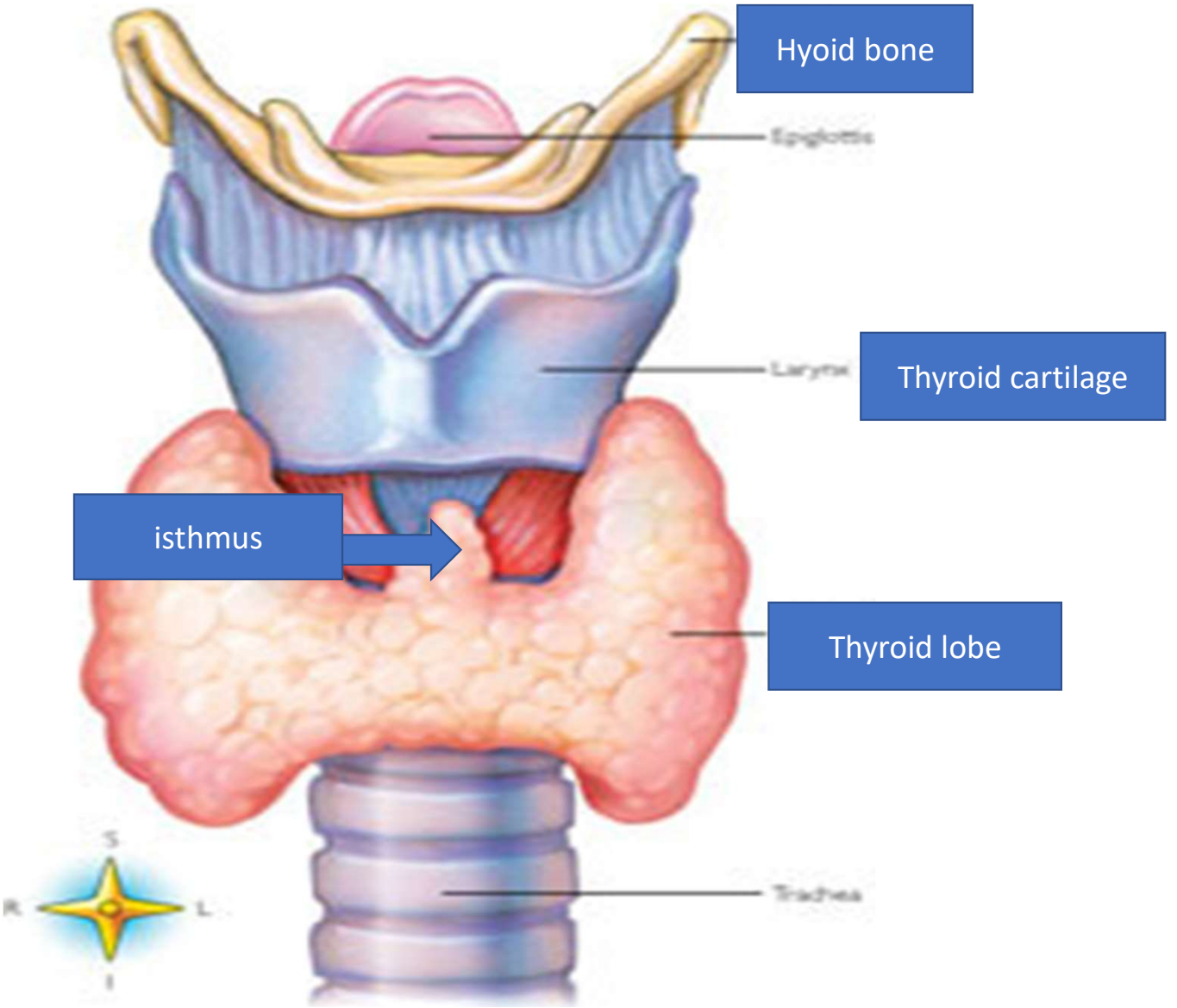
Function 3 for anterior pituitary?


Hypothalamus
Paraventricular nucleus
Supraoptic nucleus
Median eminence
Infundibulum
Anterior pituitary
Posterior pituitary
Thyrotropic cells secrete thyroid-stimulating hormone (TSH).
Thyroid
Somatotropic cells secrete growth hormone (GH).
Muscle
Adipose tissue
Bone
Mammotropic cells secrete prolactin (PRL).
Mammary gland
Gonadotropic cells secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH).
Testis
Ovary
Corticotropic cells secrete adrenocorticotropic hormone (ACTH).
Adrenal cortex
Adrenal gland
Pars intermedia cells secrete melanocyte-stimulating hormone (MSH).
Melanocytes

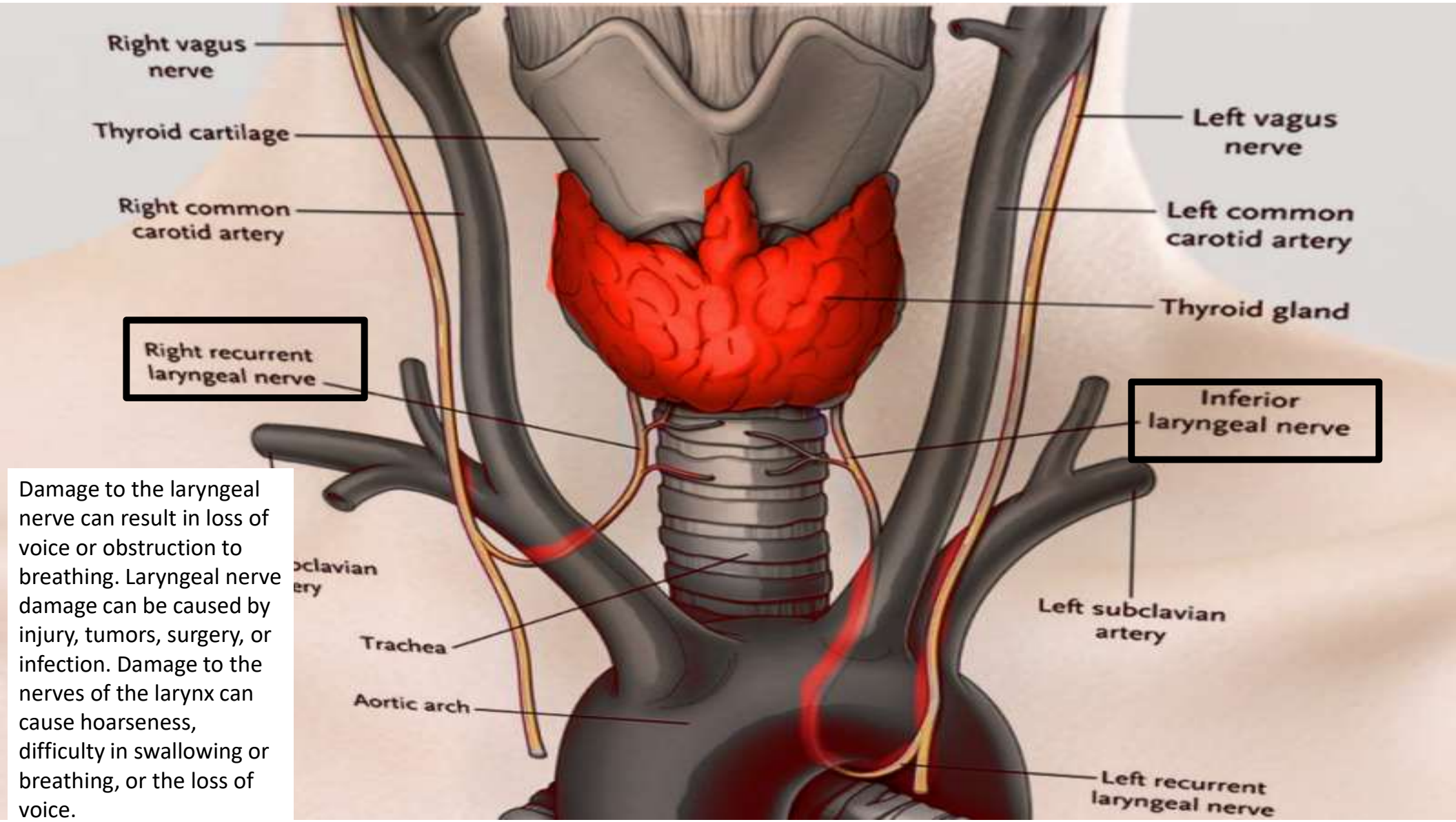


Thyroid gland

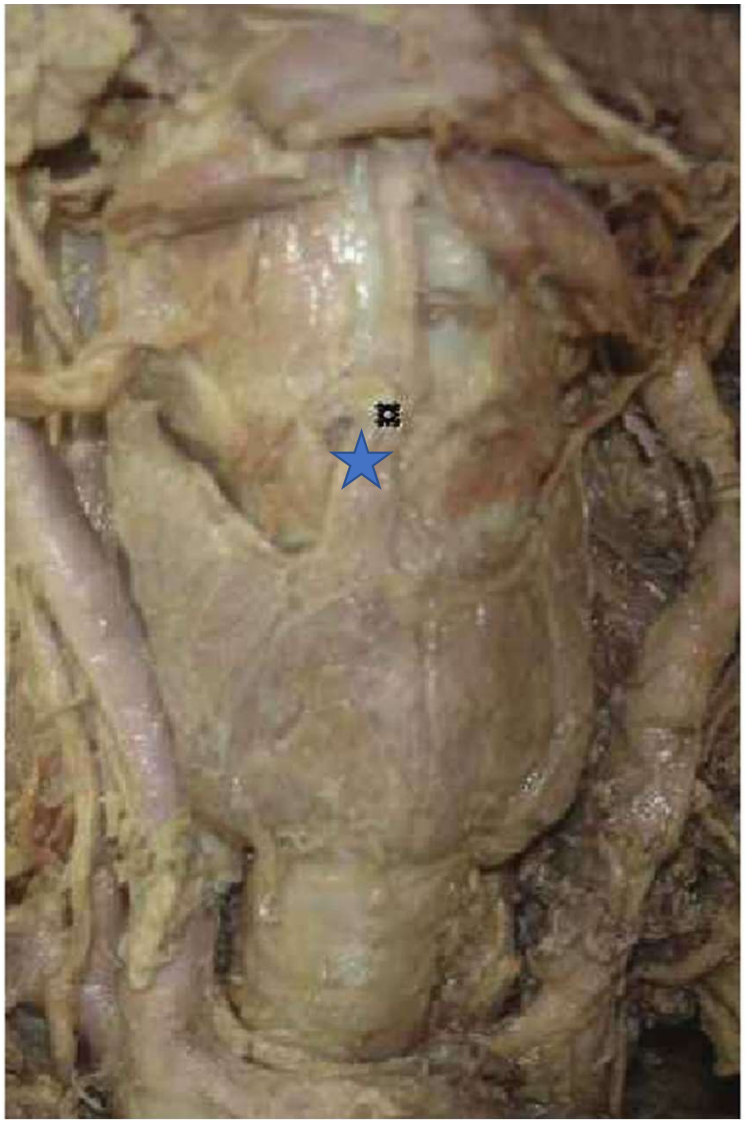

S
R
L
I


Hyoid bone
Epiglottis
Larynx
Thyroid cartilage
isthmus
Thyroid lobe
Trachea
S
R
L
I

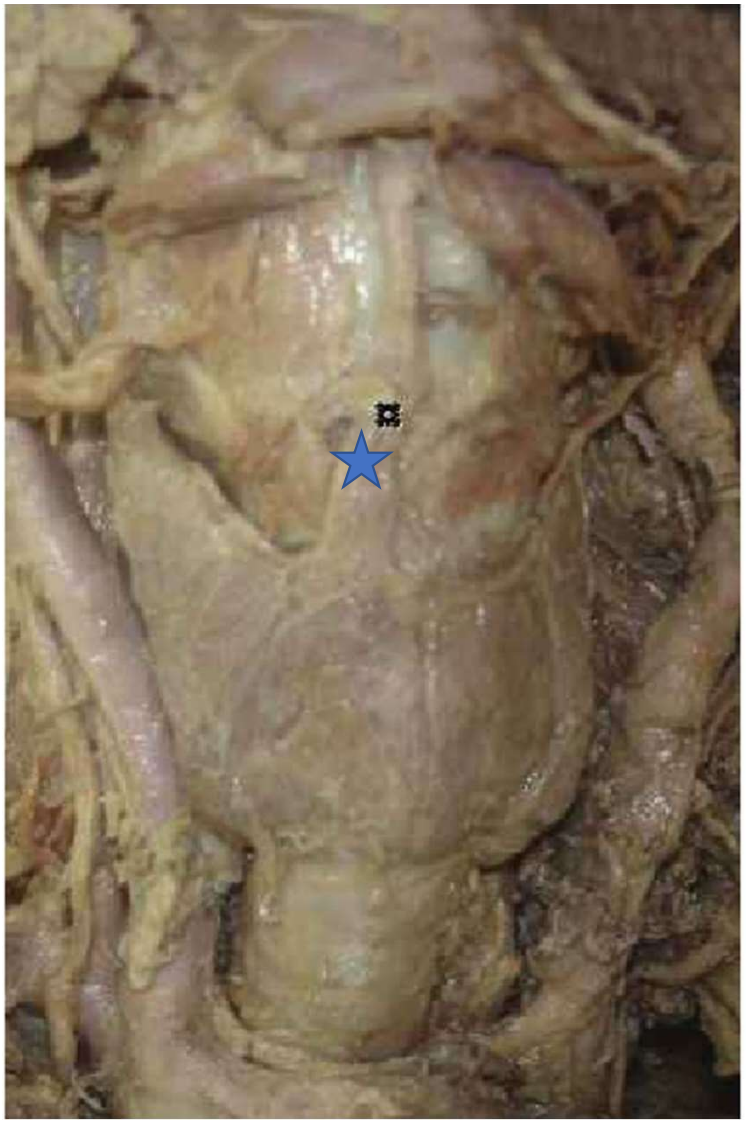
What important nerve run behind the thyroid gland?

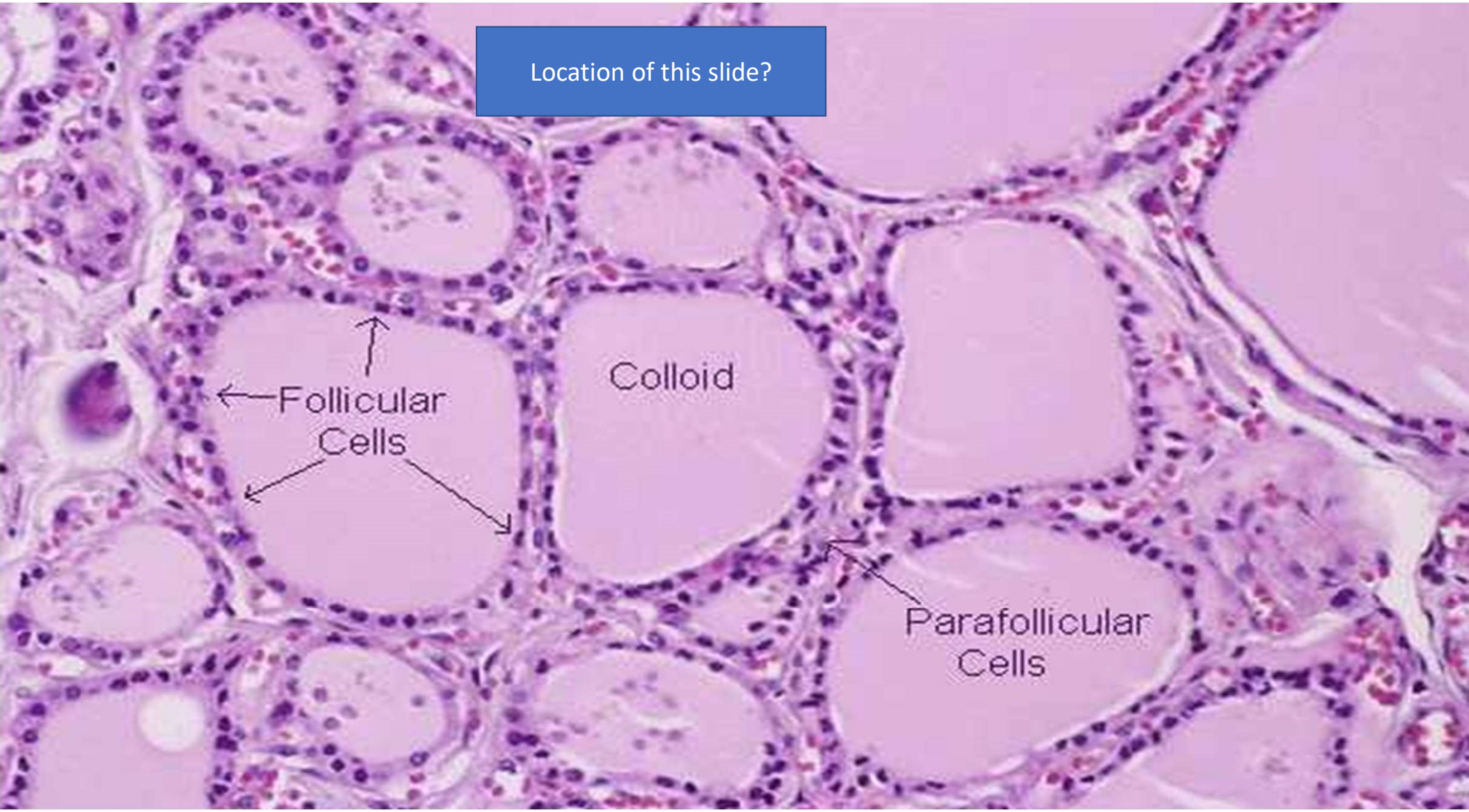


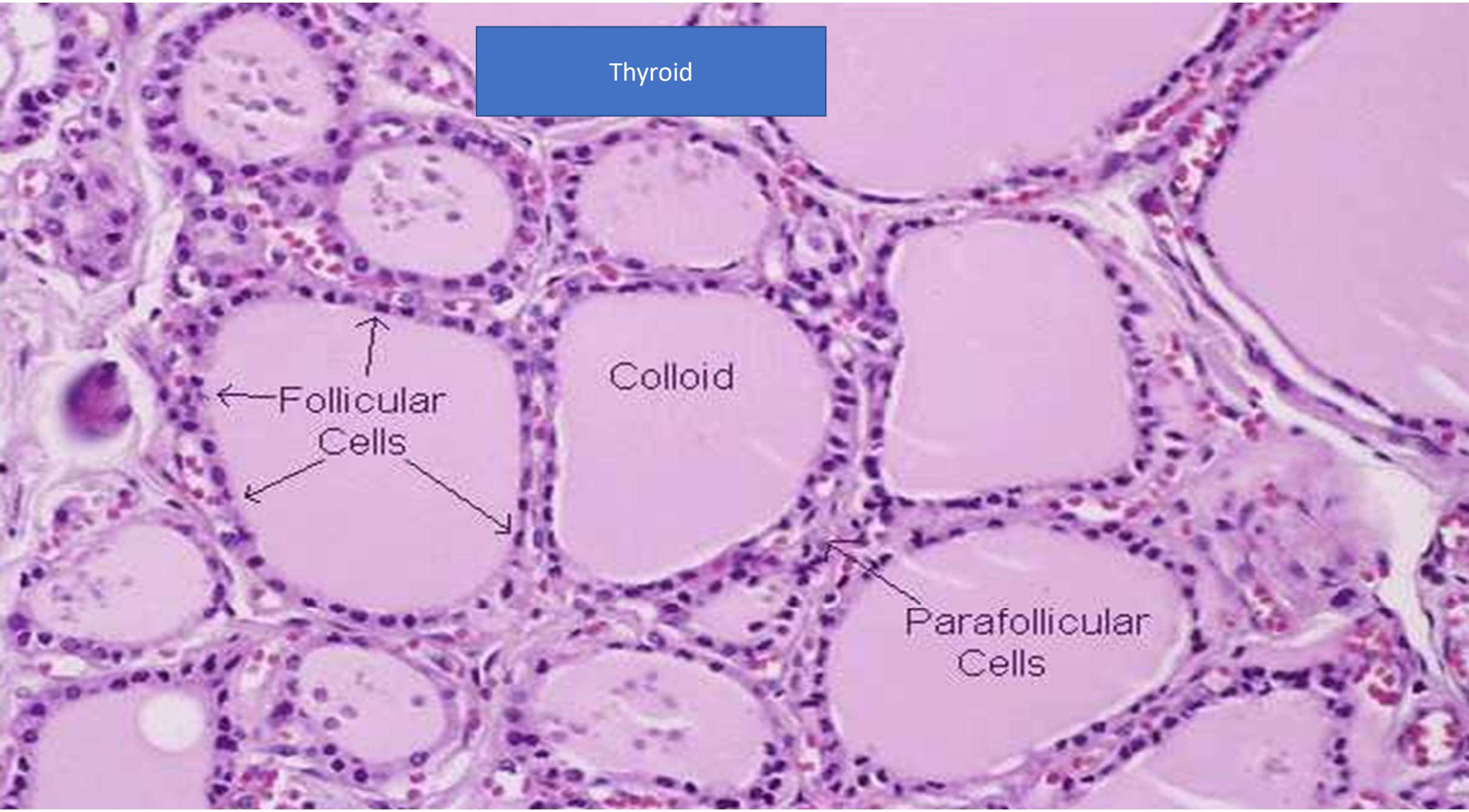
Damage to the laryngeal nerve can result in loss of voice or obstruction to breathing. Laryngeal nerve damage can be caused by injury, tumors, surgery, or infection. Damage to the nerves of the larynx can cause hoarseness, difficulty in swallowing or breathing, or the loss of voice.

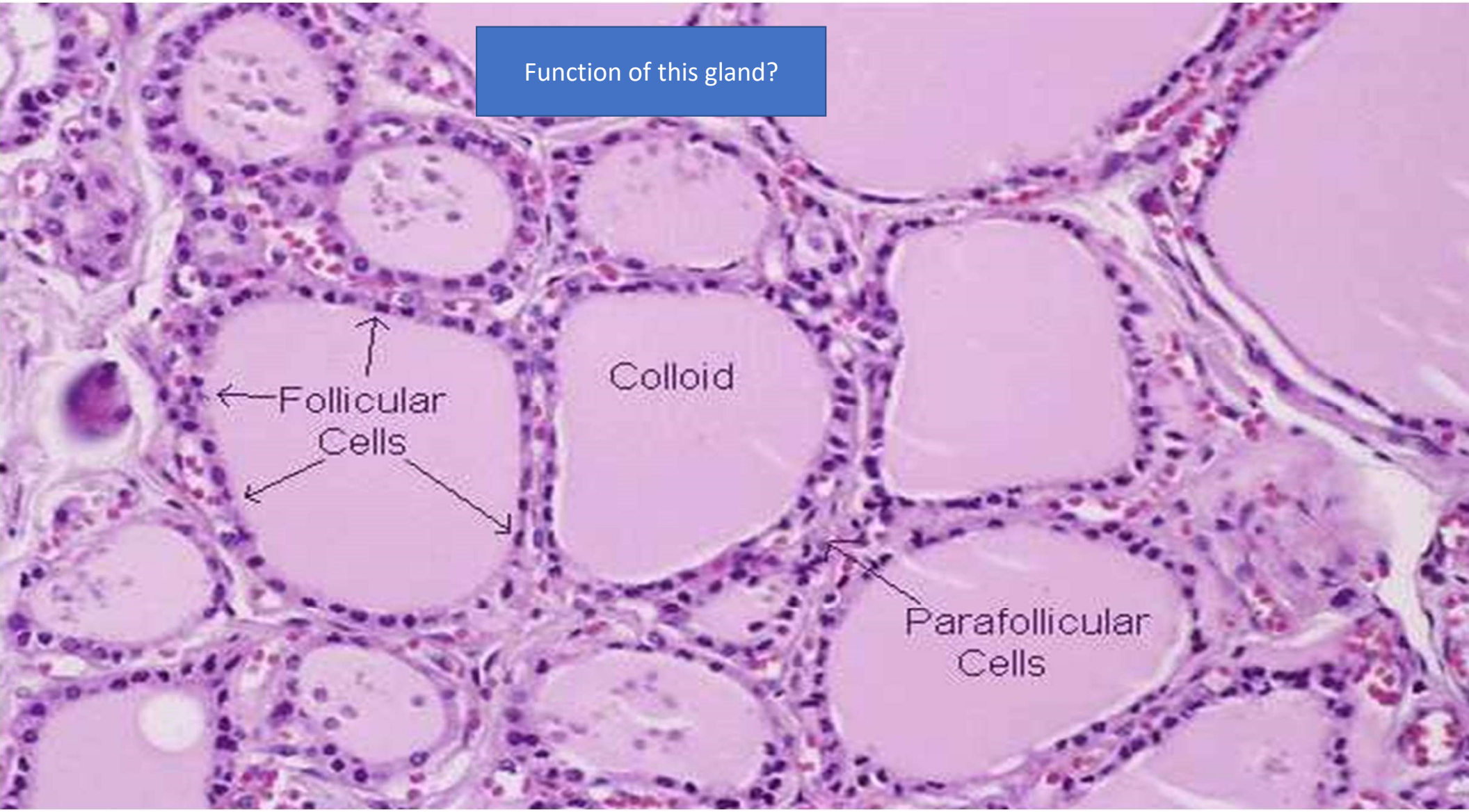


isthmus




Location of this slide?
Follicular Cells
Colloid
Parafollicular Cells


Thyroid
Follicular Cells
Colloid
Parafollicular Cells


Function of this gland?
Follicular Cells
Colloid
Parafollicular Cells

The primary function of the thyroid is the production of the iodine-containing thyroid hormones, triiodothyronine (T_3) and thyroxine (T_4) and the peptide hormone calcitonin.

The thyroid hormones have a wide range of effects on the human body. These include:

- **Metabolic.** The thyroid **hormones increase the basal metabolic rate** and have effects on almost all body tissues. Appetite, the absorption of substances, and gut motility are all influenced by thyroid hormones.
  - They increase the absorption in the gut, generation, uptake by cells, and breakdown of glucose.
  - They stimulate the breakdown of fats, and increase the number of free fatty acids.
  - Despite increasing free fatty acids, thyroid hormones decrease cholesterol levels, perhaps by increasing the rate of secretion of cholesterol in bile.
- **Cardiovascular.** The hormones increase the rate and strength of the heartbeat.
  - They increase the rate of breathing, intake and consumption of oxygen, and increase the activity of mitochondria.
  - Combined, these factors increase blood flow and the body's temperature.
- **Developmental.** Thyroid hormones are important for normal development.
  - They increase the growth rate of young people, and cells of the developing brain are a major target for the thyroid hormones T_3 and T_4.
  - Thyroid hormones play a particularly crucial role in brain maturation during fetal development and first few years of postnatal life
- The thyroid hormones also play a role in maintaining normal sexual function, sleep, and thought patterns. Increased levels are associated with increased speed of thought generation but decreased focus. Sexual function, including libido and the maintenance of a normal menstrual cycle, are influenced by thyroid hormones.

Calcitonin

The thyroid gland also produces the hormone calcitonin, which helps regulate blood calcium levels. Parafollicular cells produce calcitonin in response to high blood calcium.

Calcitonin decreases the release of calcium from bone, by decreasing the activity of osteoclasts, cells which break down bone.

Bone is constantly reabsorbed by osteoclasts and created by osteoblasts, so calcitonin effectively stimulates movement of calcium into bone.

The effects of calcitonin are opposite those of the parathyroid hormone (PTH) produced in the parathyroid glands.

However, calcitonin seems far less essential than PTH, since calcium metabolism remains clinically normal after removal of the thyroid (thyroidectomy), but not the parathyroid glands.

What hormone (s) are working at this moment?

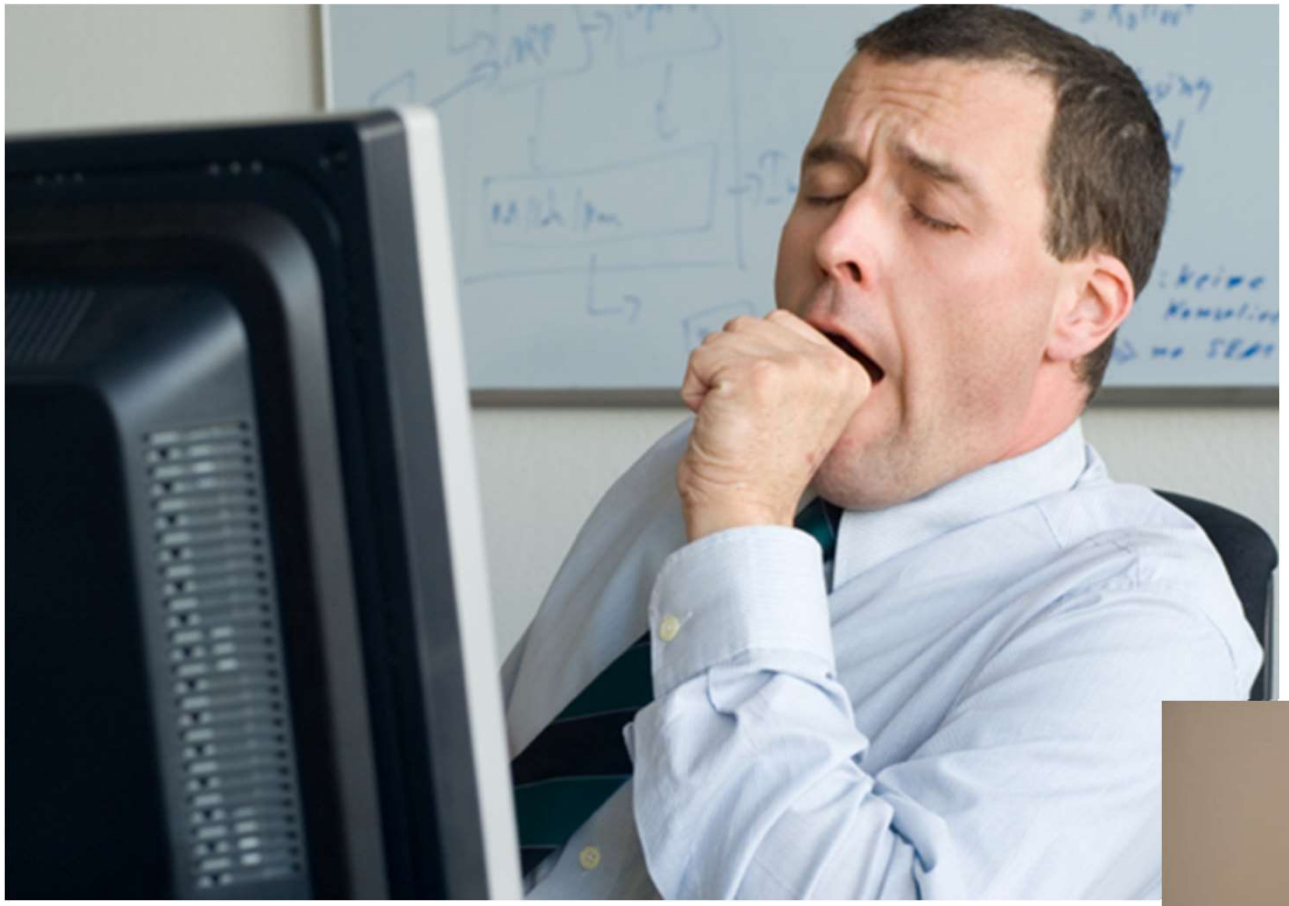
What hormone (s) are working at this moment?

Melanocyte-stimulating hormone (MSH): regulates skin pigmentation and promotes the deposit of melanine in the skin after exposure to sunlight

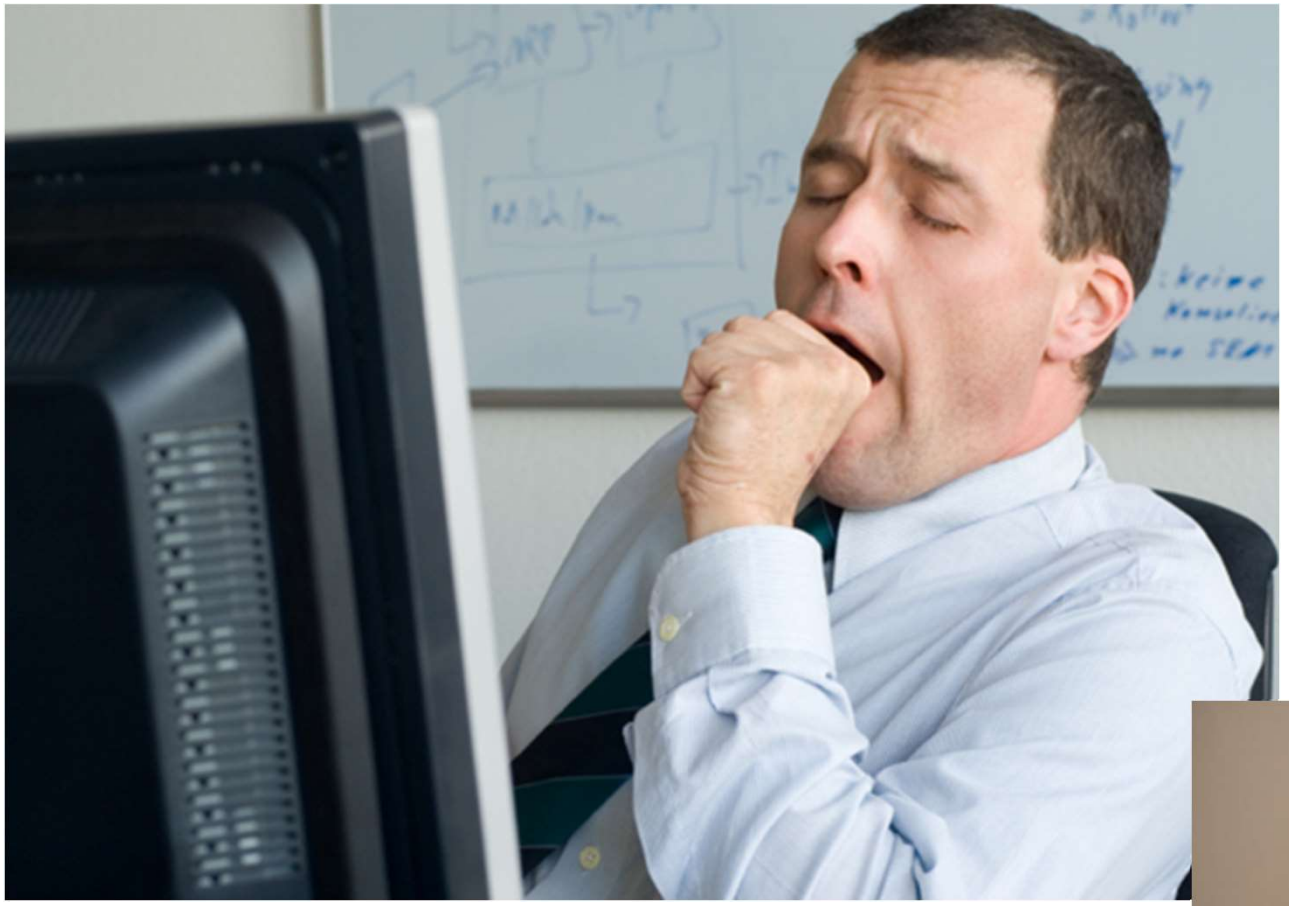
Which hormone is important t these two points?

Which hormone is important t these two points?

Oxytocin: stimulates the uterus to contract during labor, delivery, and parturition. A synthetic version of this hormone, used to induce labor, is called Pitocin. It also stimulates the mammary glands to release milk.



Guess which hormone/



Guess which hormone/

Serotonin: a neurotransmitter that regulates intestinal movements and affects appetite, mood, sleep, anger, and metabolism

Which hormone is missing in the growth of this child?

Which hormone is missing in the growth of this child?

Thyroid hormone (hypothyroidism)

Thyroxine (T4) and triodothyronine (T3): essential to BMR – basal metabolic rate (the rate at which a person's body burns calories while at rest); influences physical/mental development and growth

Which hormones are working well in this guy?

Which hormones are working well in this guy?

Androgens: several hormones including testosterone; they promote the development of secondary sex characteristics in the male.

??????????????

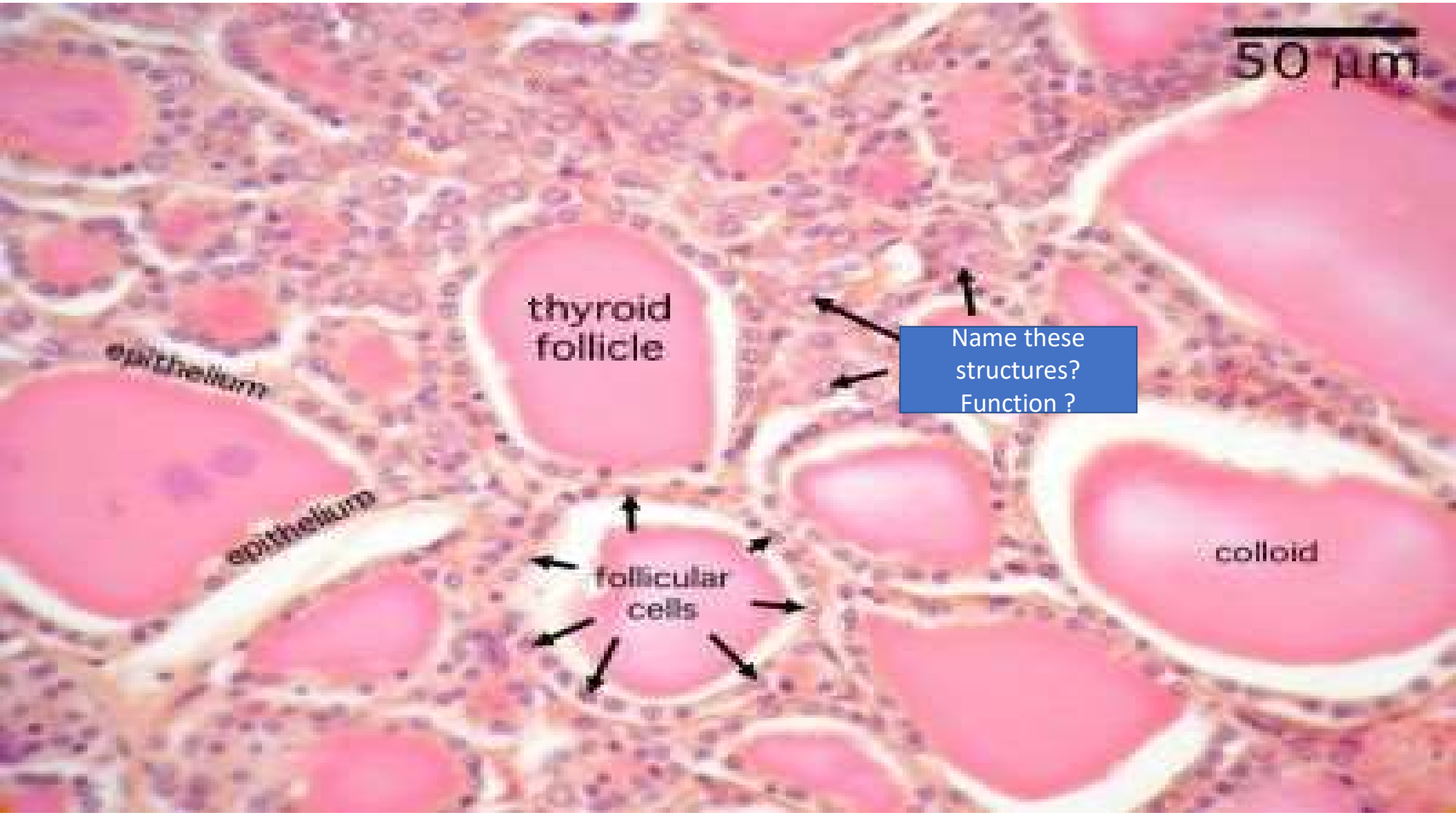
??????????????

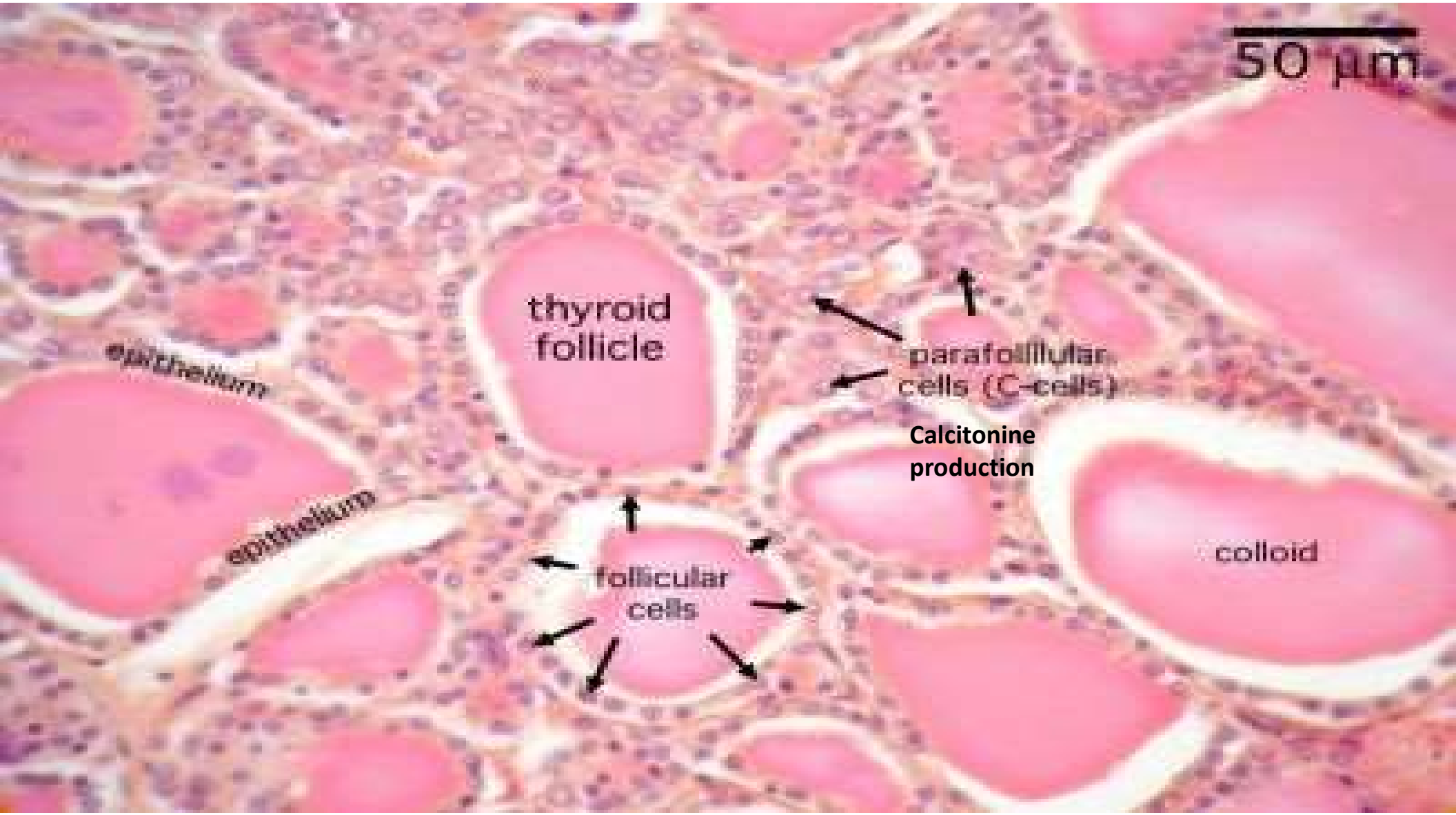
Norepinephrine, like epinephrine, is released when the body is under stress. It creates the underlying influence in the *fight or flight response*. As a drug, however, it actually triggers a drop in heart rate.

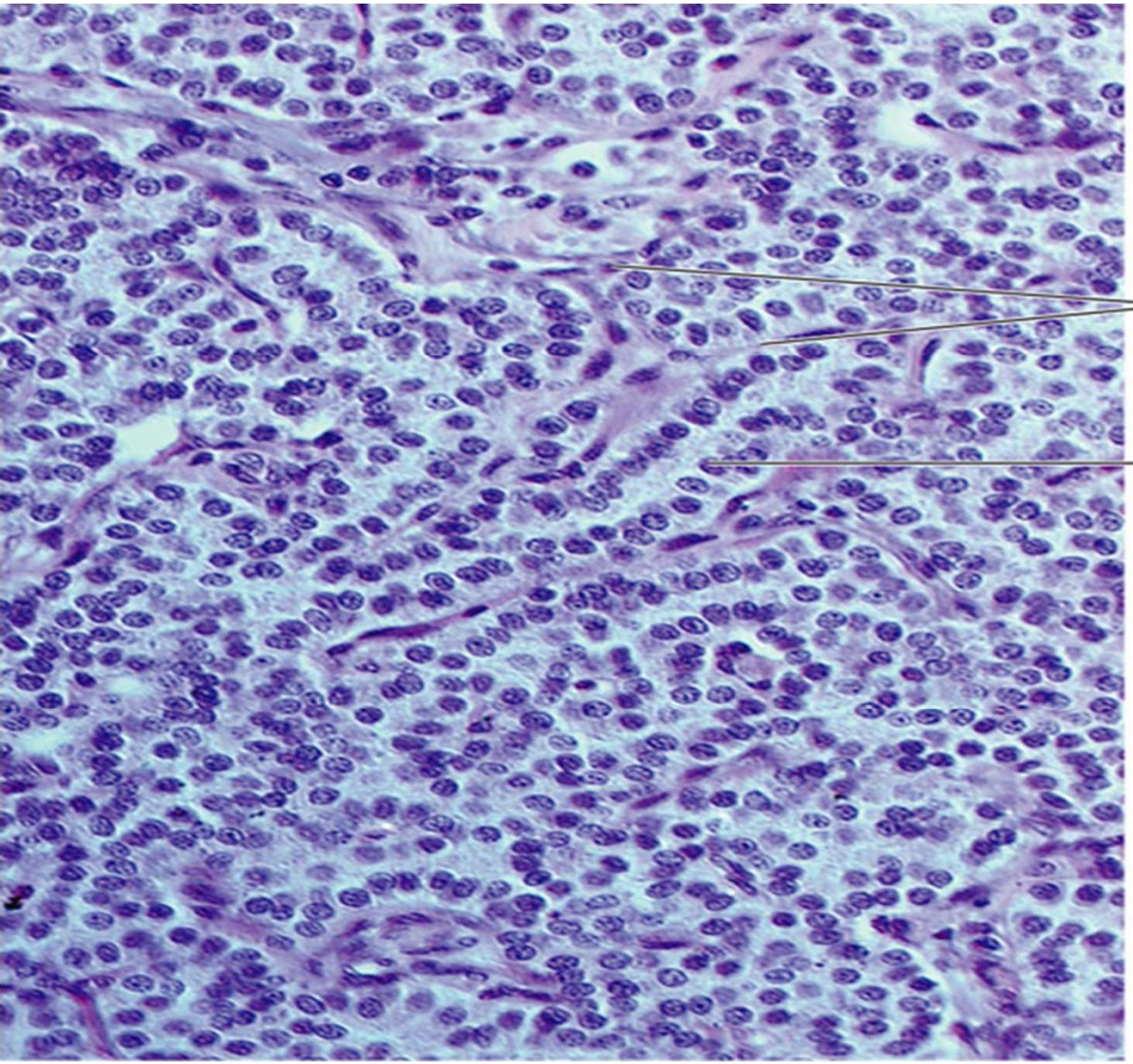
What mystery can this be?

What mystery can this be?

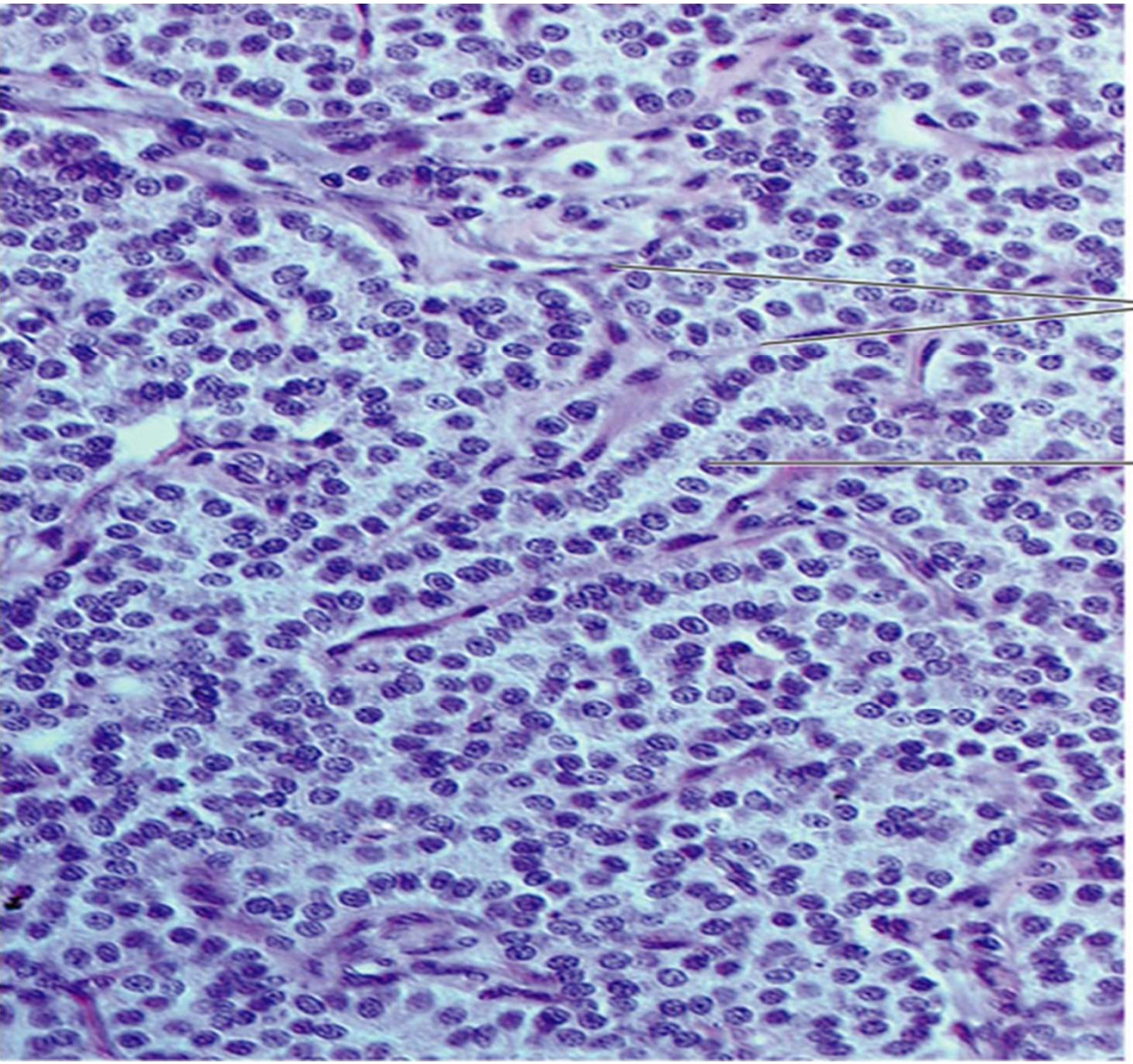
Growth Hormone (GH): essential for the growth and development of bones, muscles, and other organs. It also enhances protein synthesis, decreases the use of glucose, and promotes fat destruction


50 µm
thyroid follicle
Name these structures? Function ?
epithelium
epithelium
follicular cells
colloid

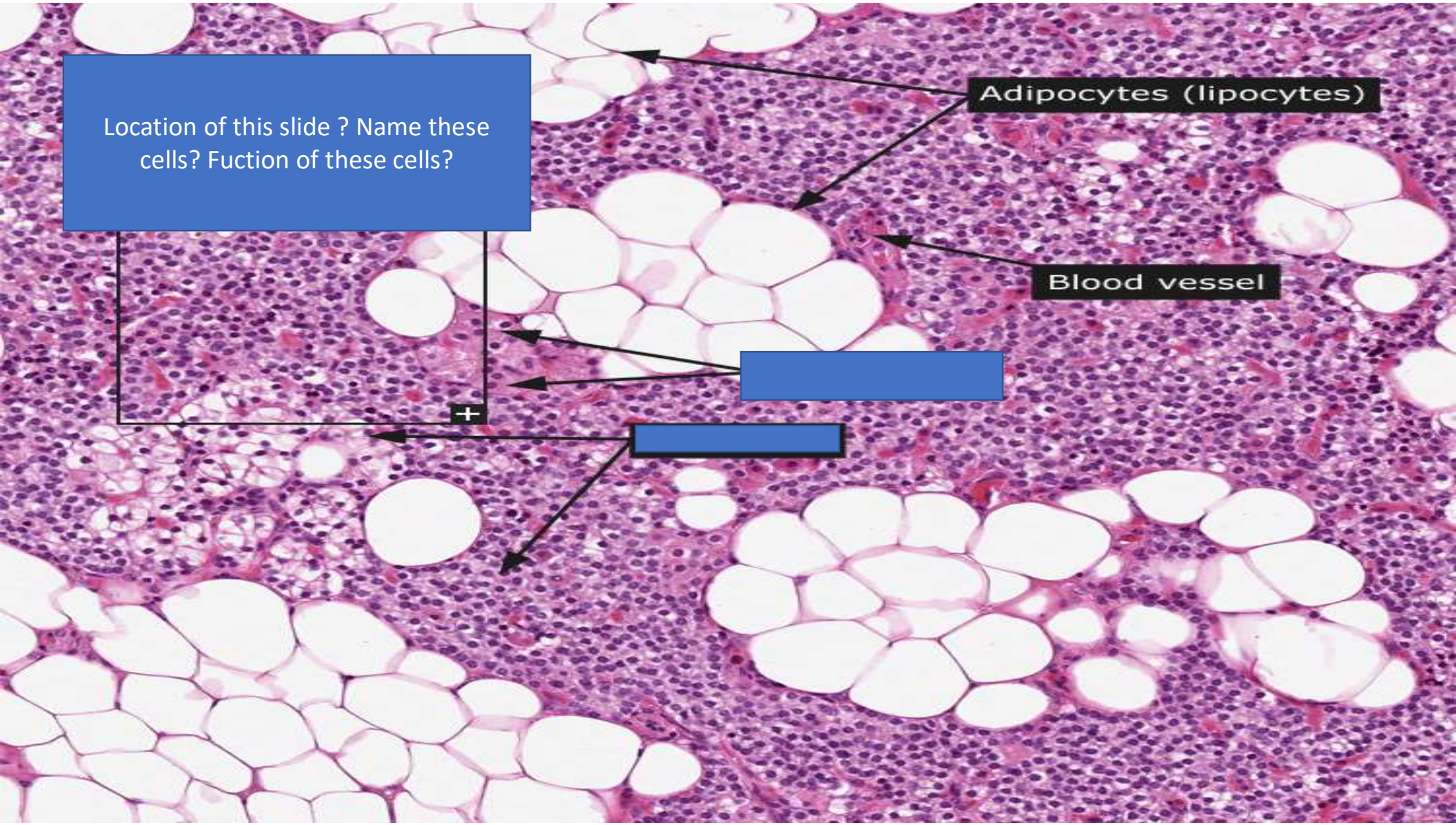

50 µm
thyroid follicle
parafollilular cells (C-cells)
Calcitonine production
epithelium
follicular cells
colloid

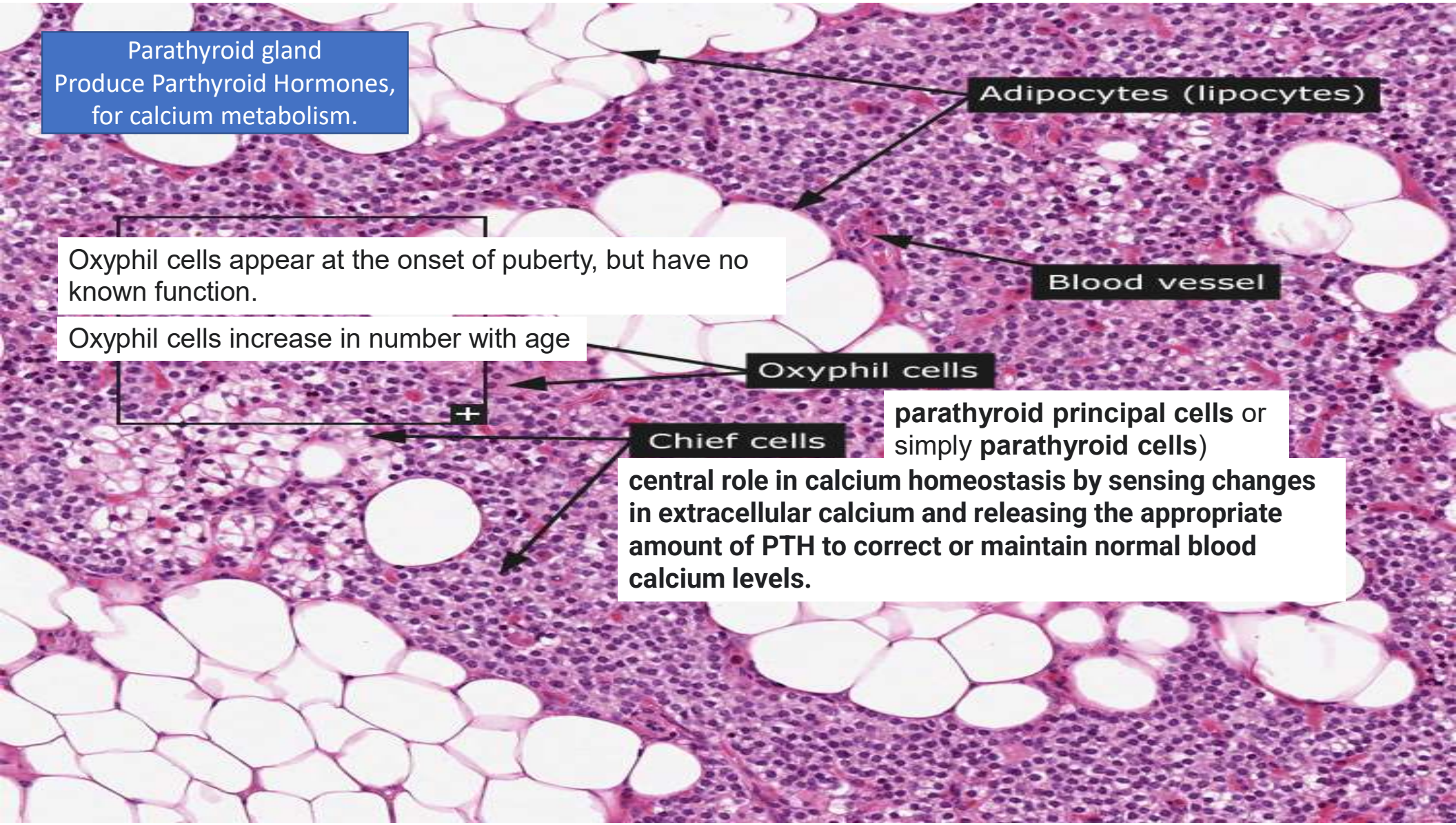


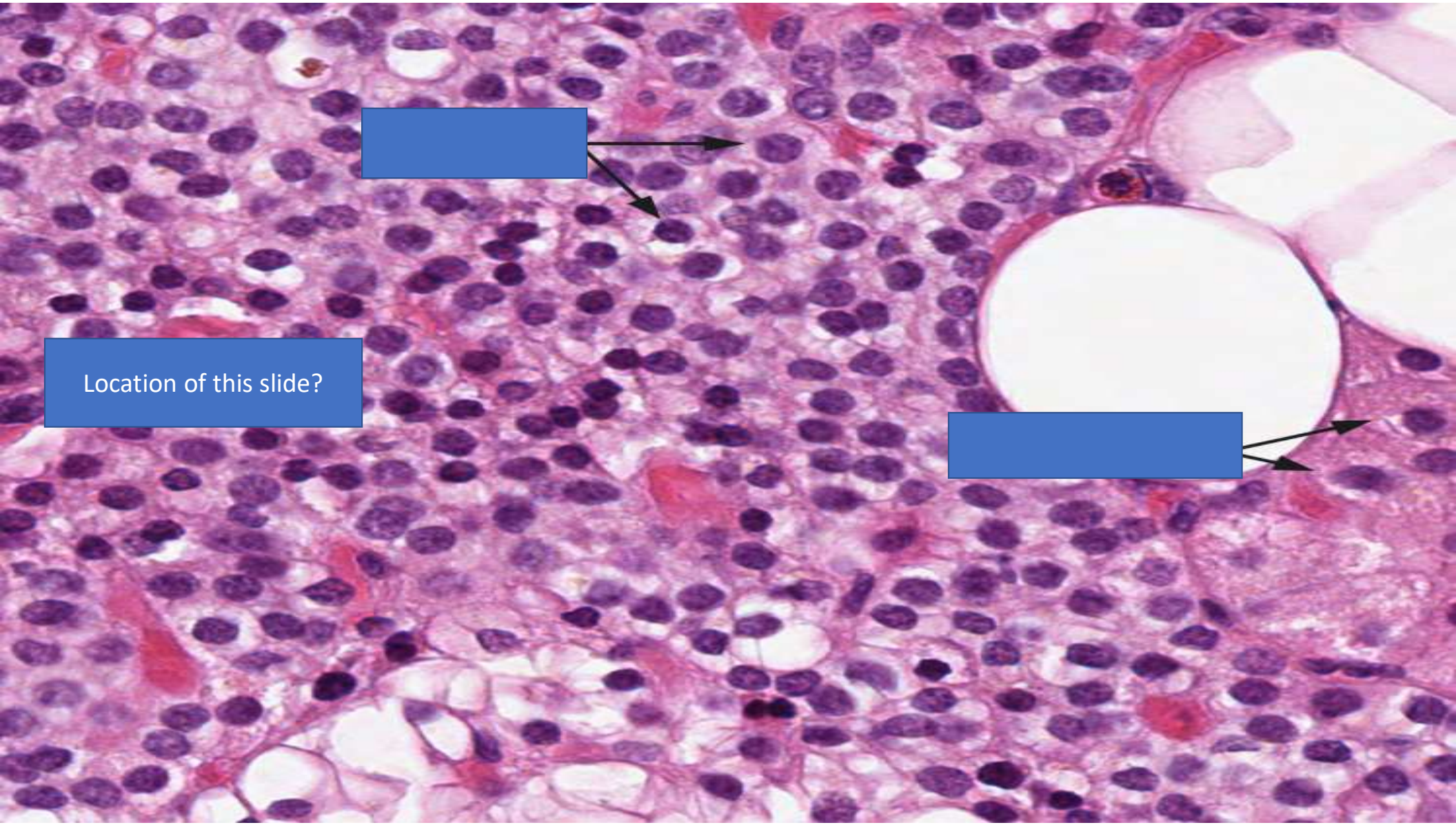
Location of this slide?

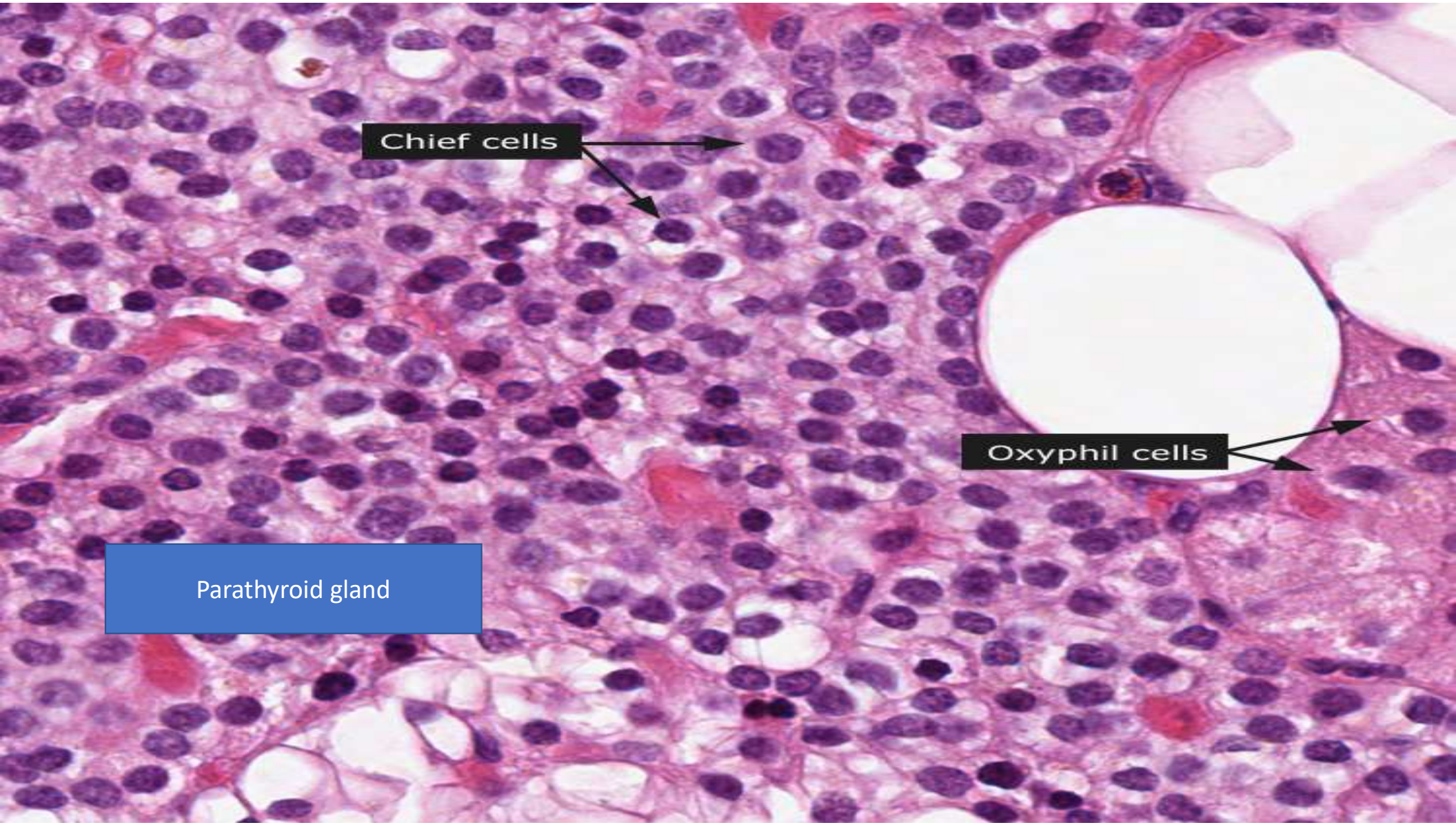


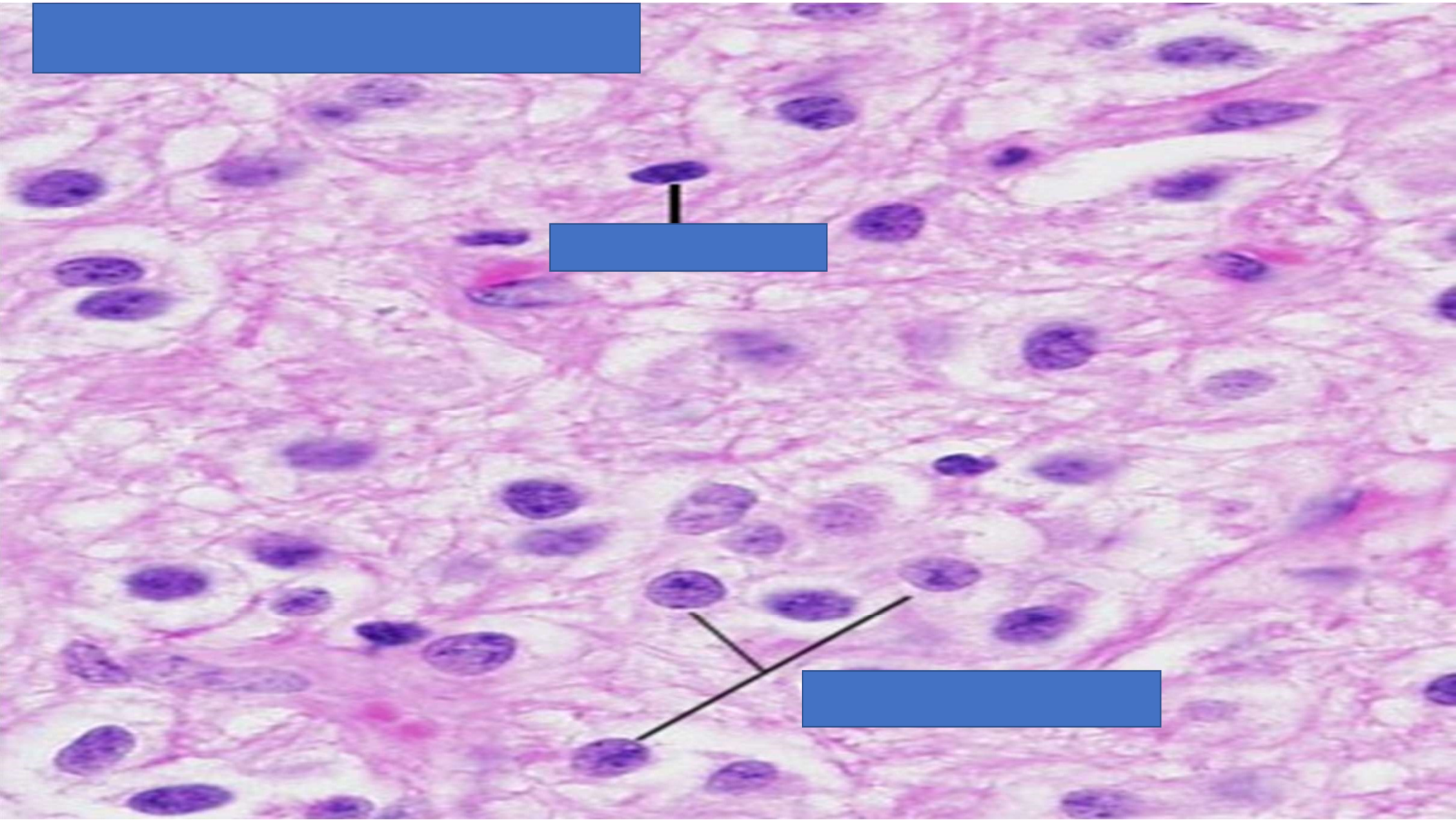
parathyroid

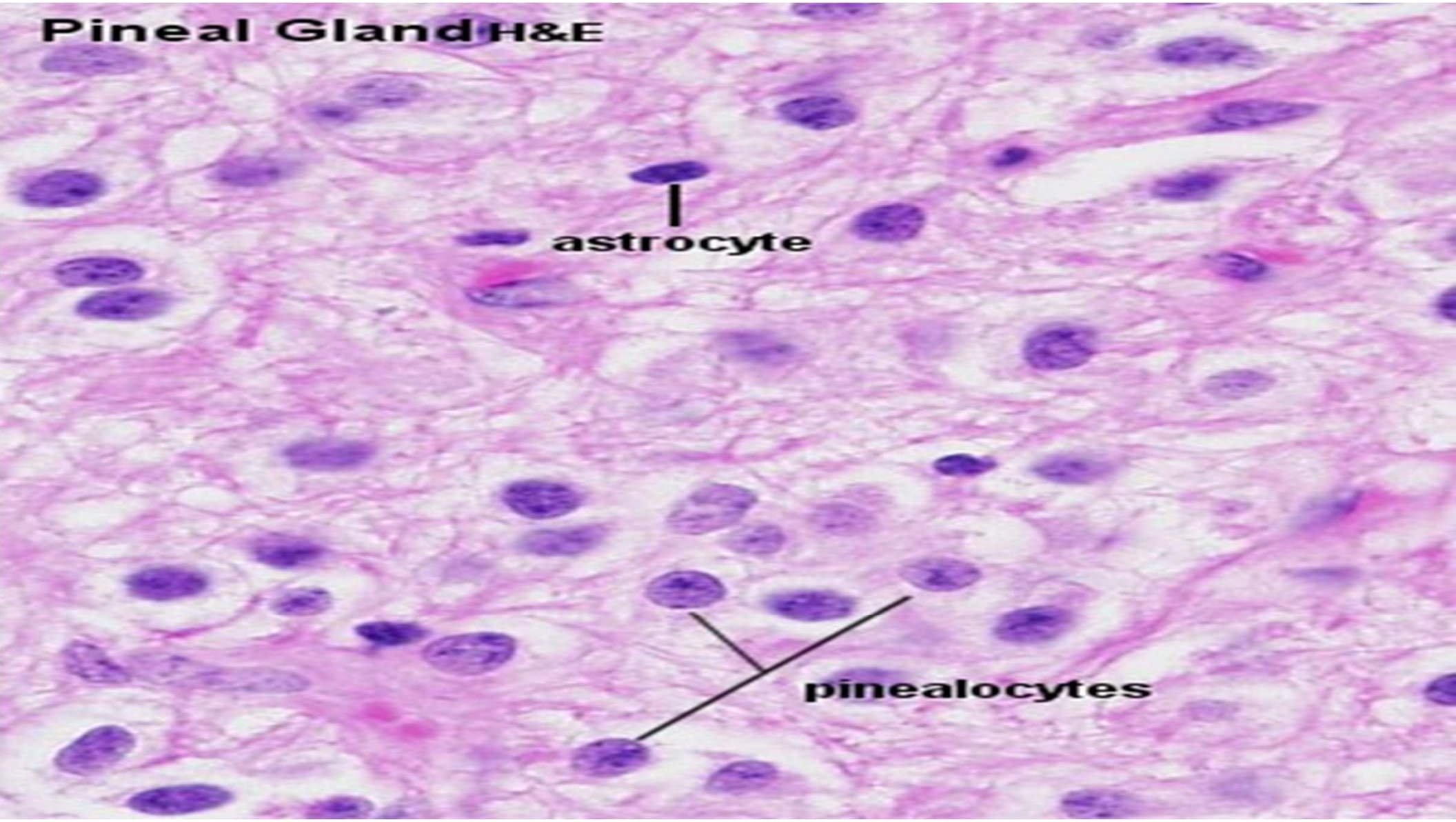

Location of this slide ? Name these cells? Fuction of these cells?
Adipocytes (lipocytes)
Blood vessel
+

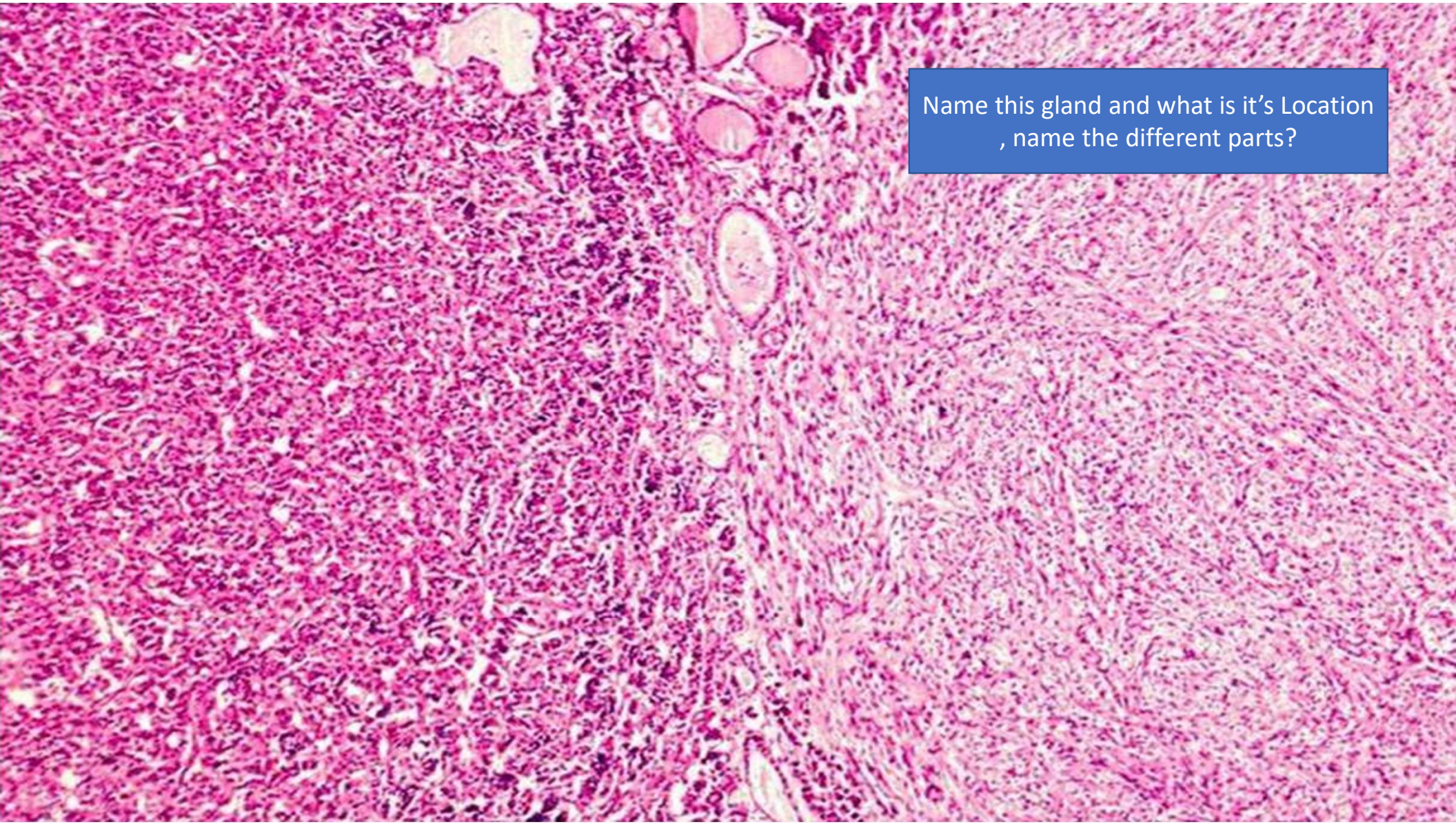

Parathyroid gland
Produce Parthyroid Hormones, for calcium metabolism.
Adipocytes (lipocytes)
Blood vessel
Oxyphil cells appear at the onset of puberty, but have no known function.
Oxyphil cells increase in number with age
Oxyphil cells
+
Chief cells
parathyroid principal cells or simply **parathyroid cells**)
central role in calcium homeostasis by sensing changes in extracellular calcium and releasing the appropriate amount of PTH to correct or maintain normal blood calcium levels.

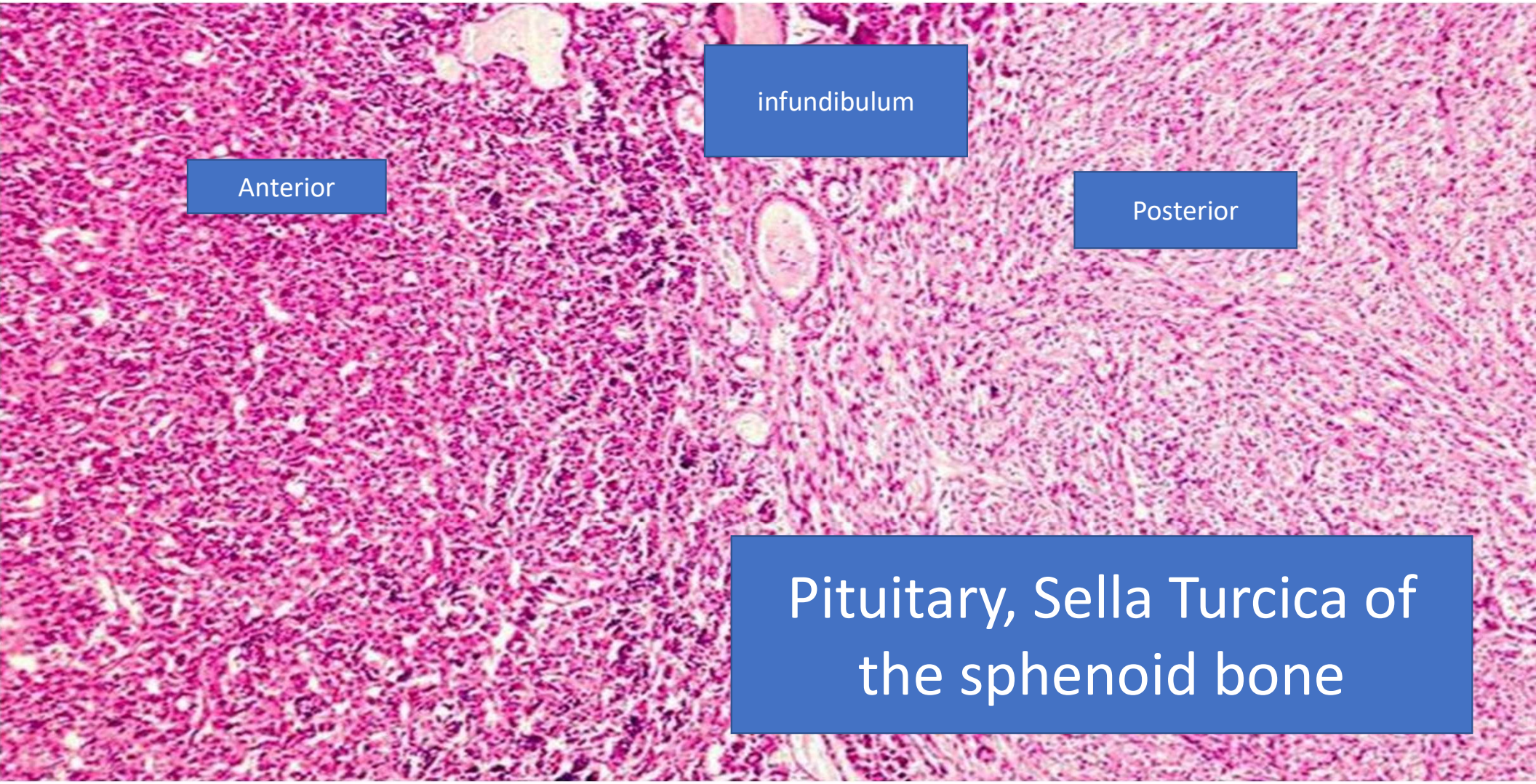

Location of this slide?

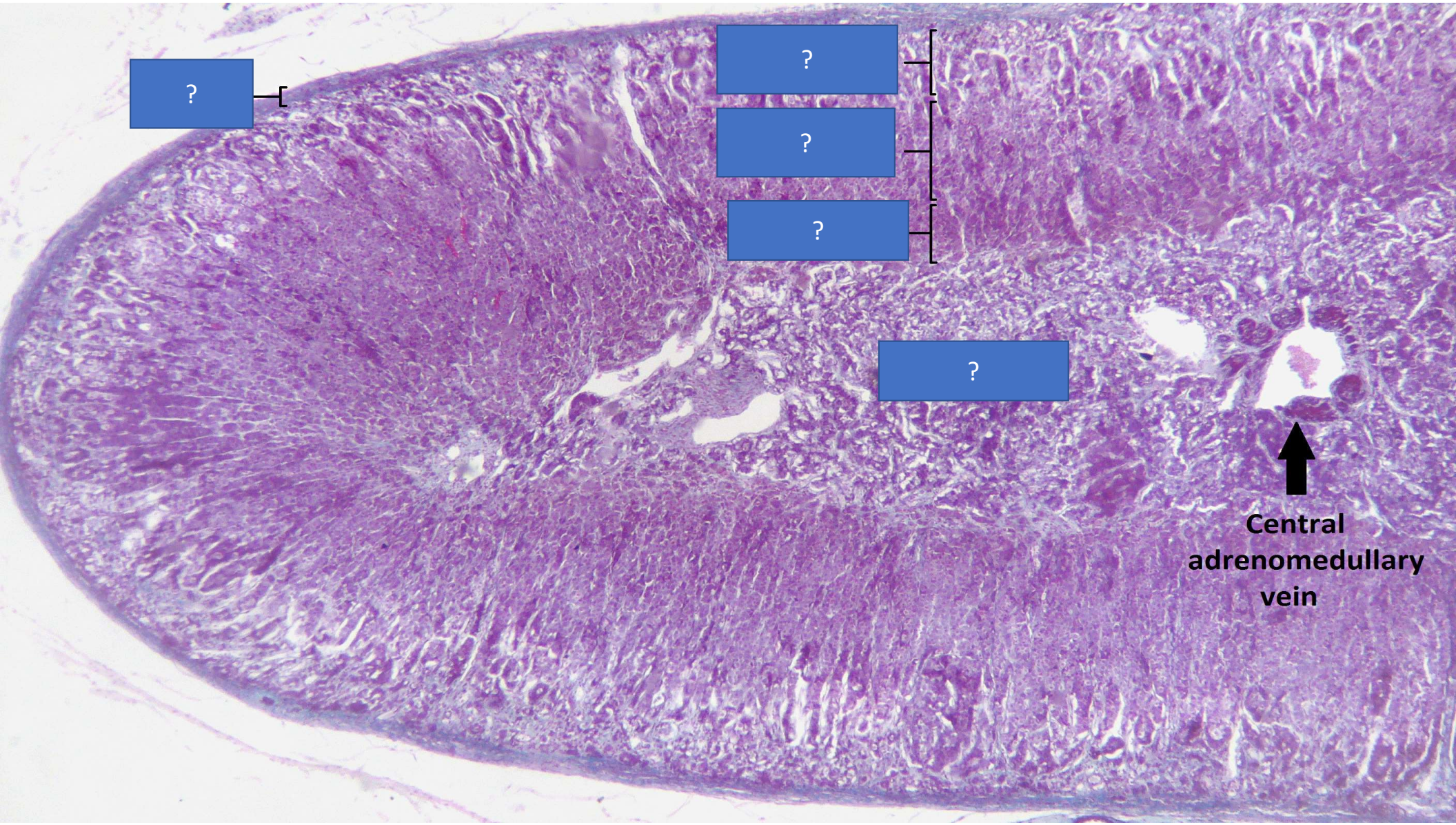

Chief cells
Oxyphil cells
Parathyroid gland

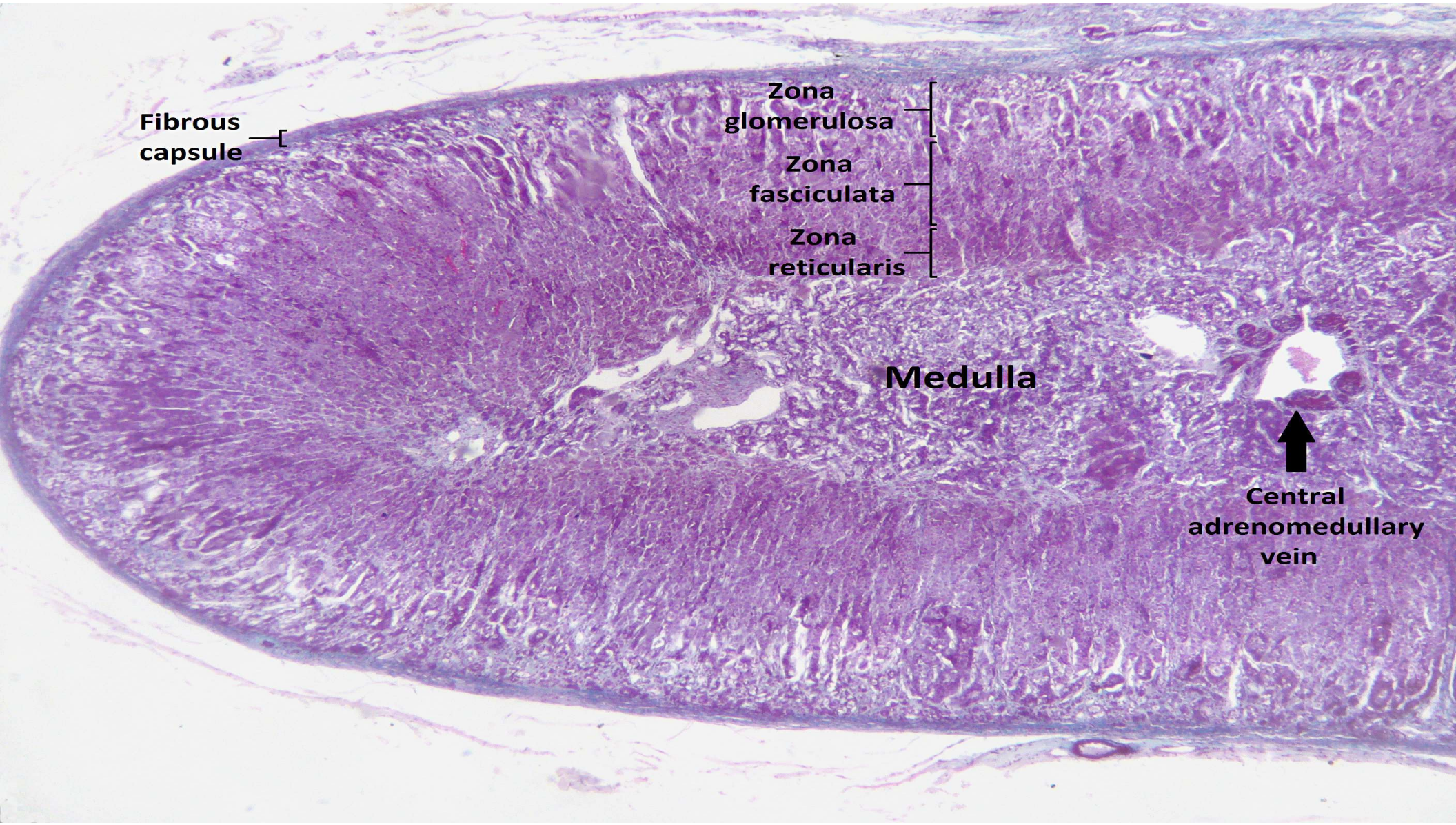


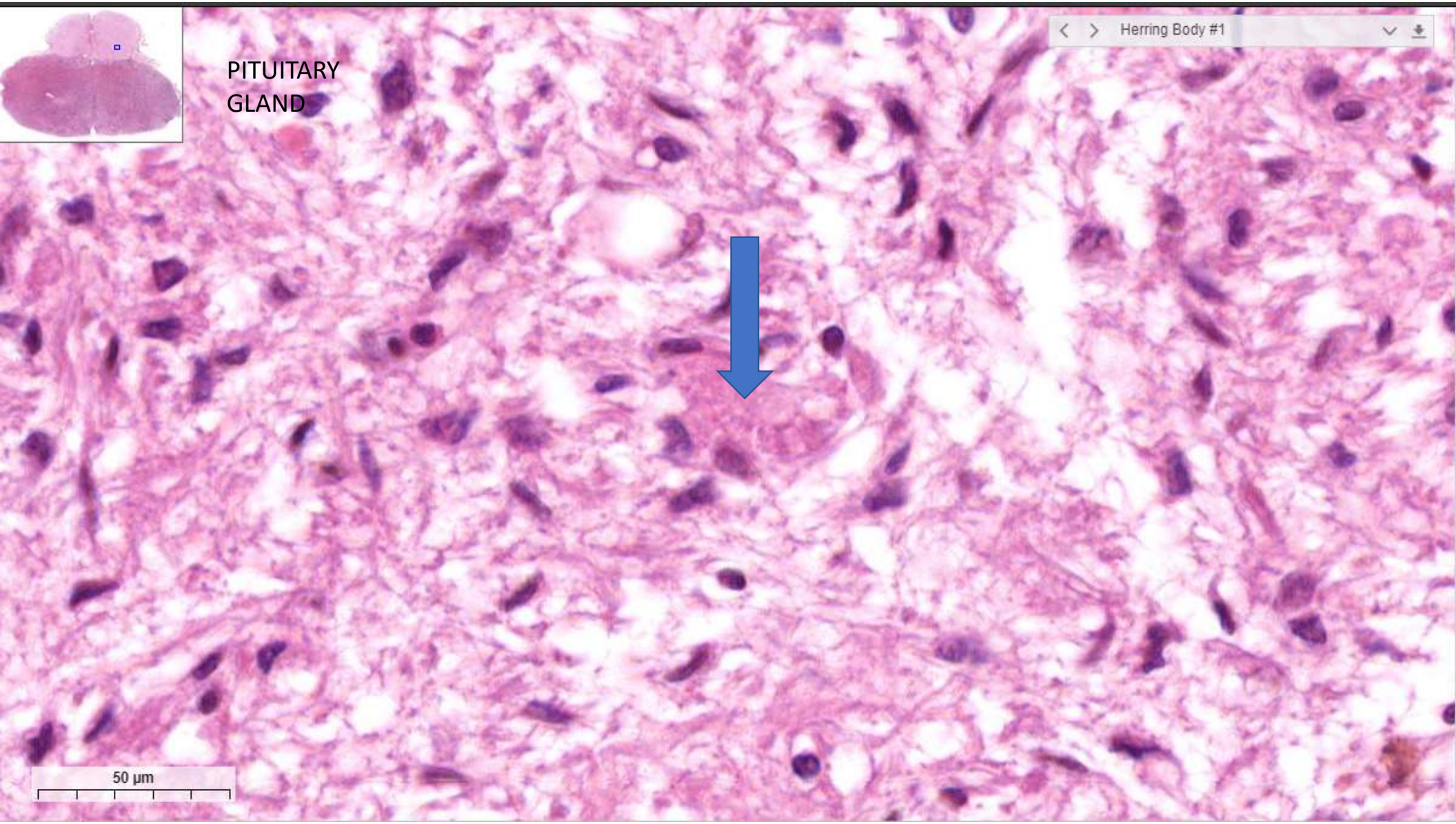

Pineal Gland H&E
astrocyte
pinealocytes


Name this gland and what is it’s Location , name the different parts?


infundibulum
Anterior
Posterior
Pituitary, Sella Turcica of the sphenoid bone

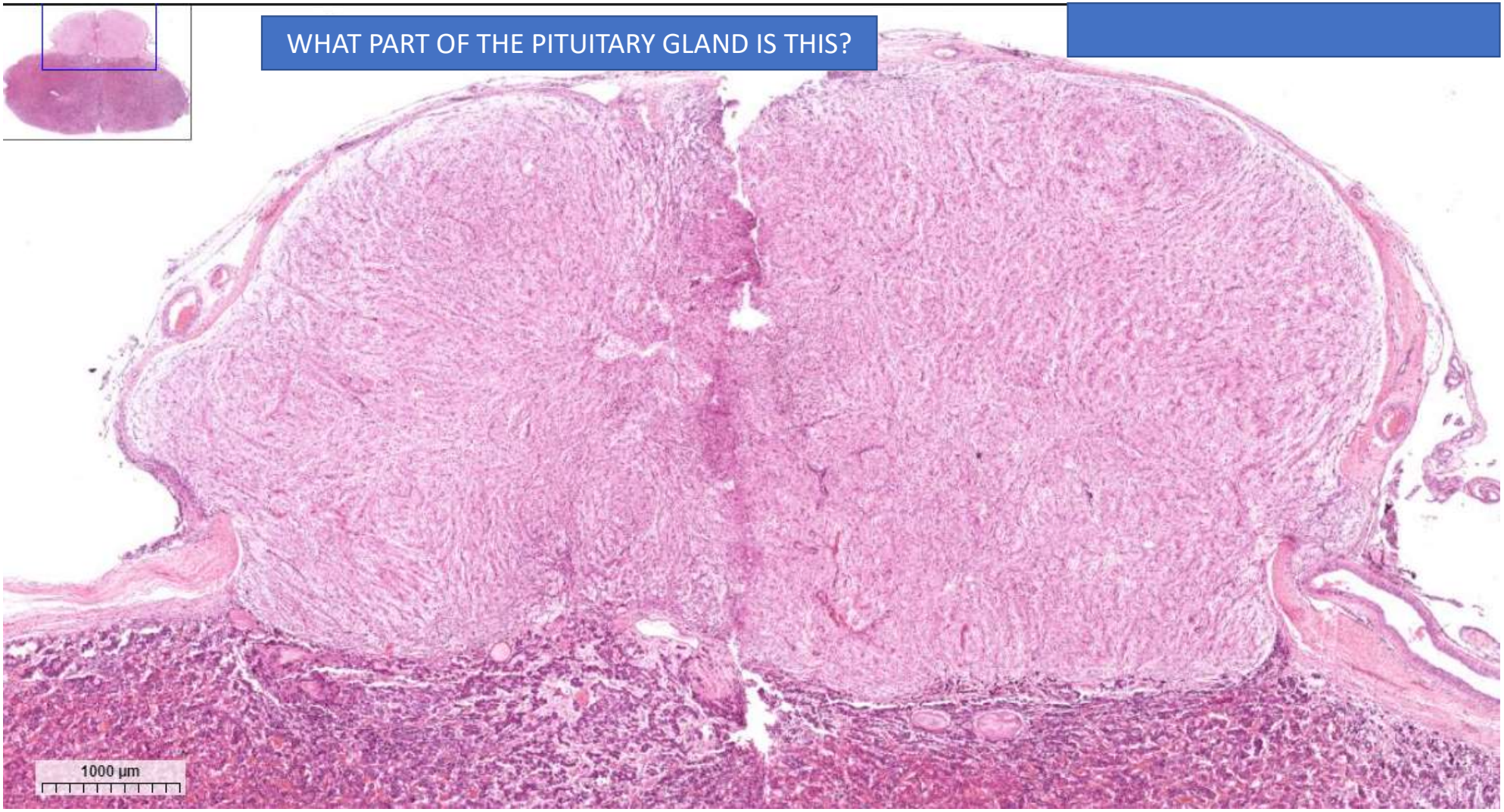

?
?
?
?
?
Central adrenomedullary vein

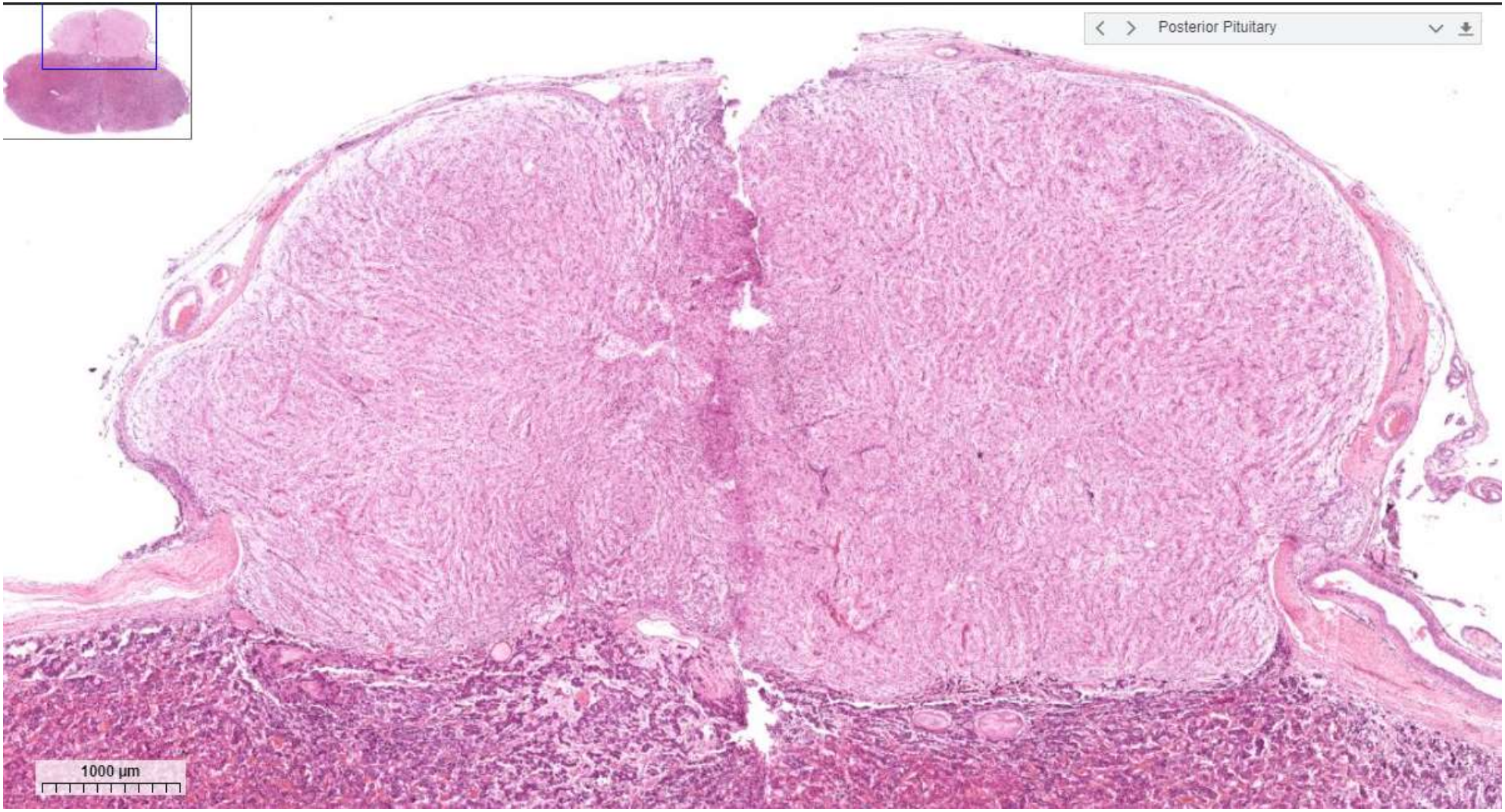

Fibrous capsule
Zona glomerulosa
Zona fasciculata
Zona reticularis
Medulla
Central adrenomedullary vein

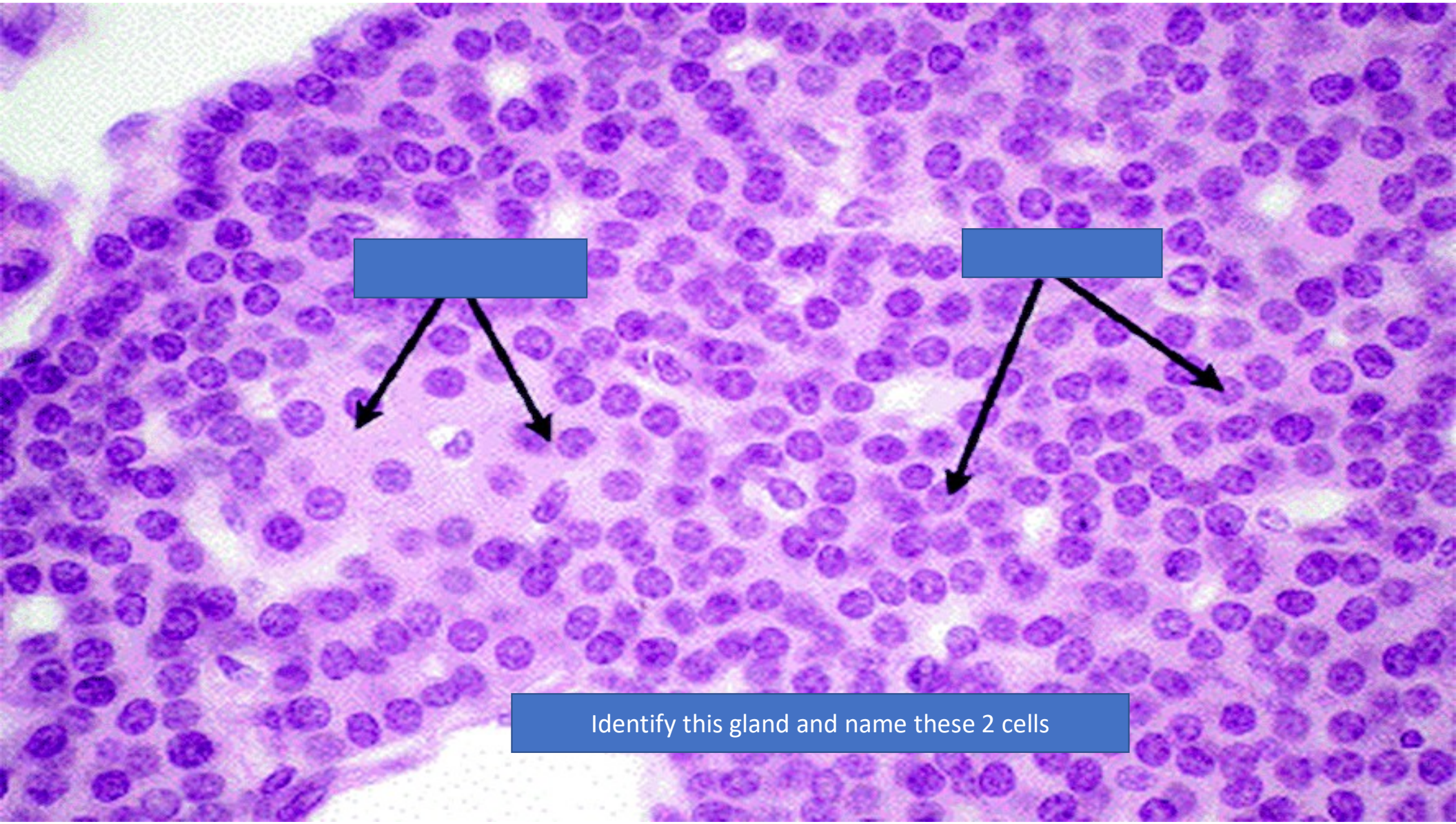

PITUITARY
GLAND
Herring Body #1
50 µm

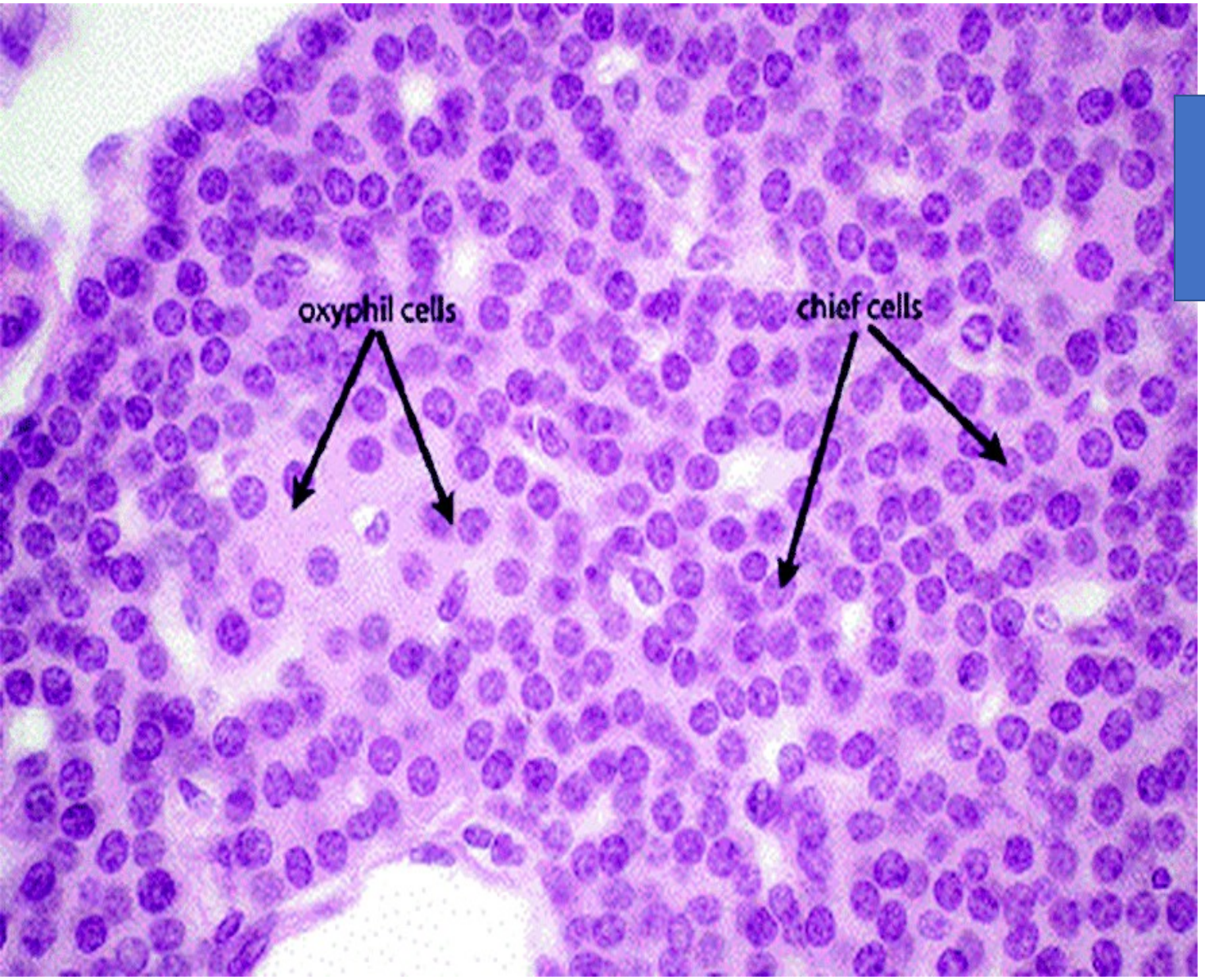
Herring Bodies

WHAT PART OF THE PITUITARY GLAND IS THIS?



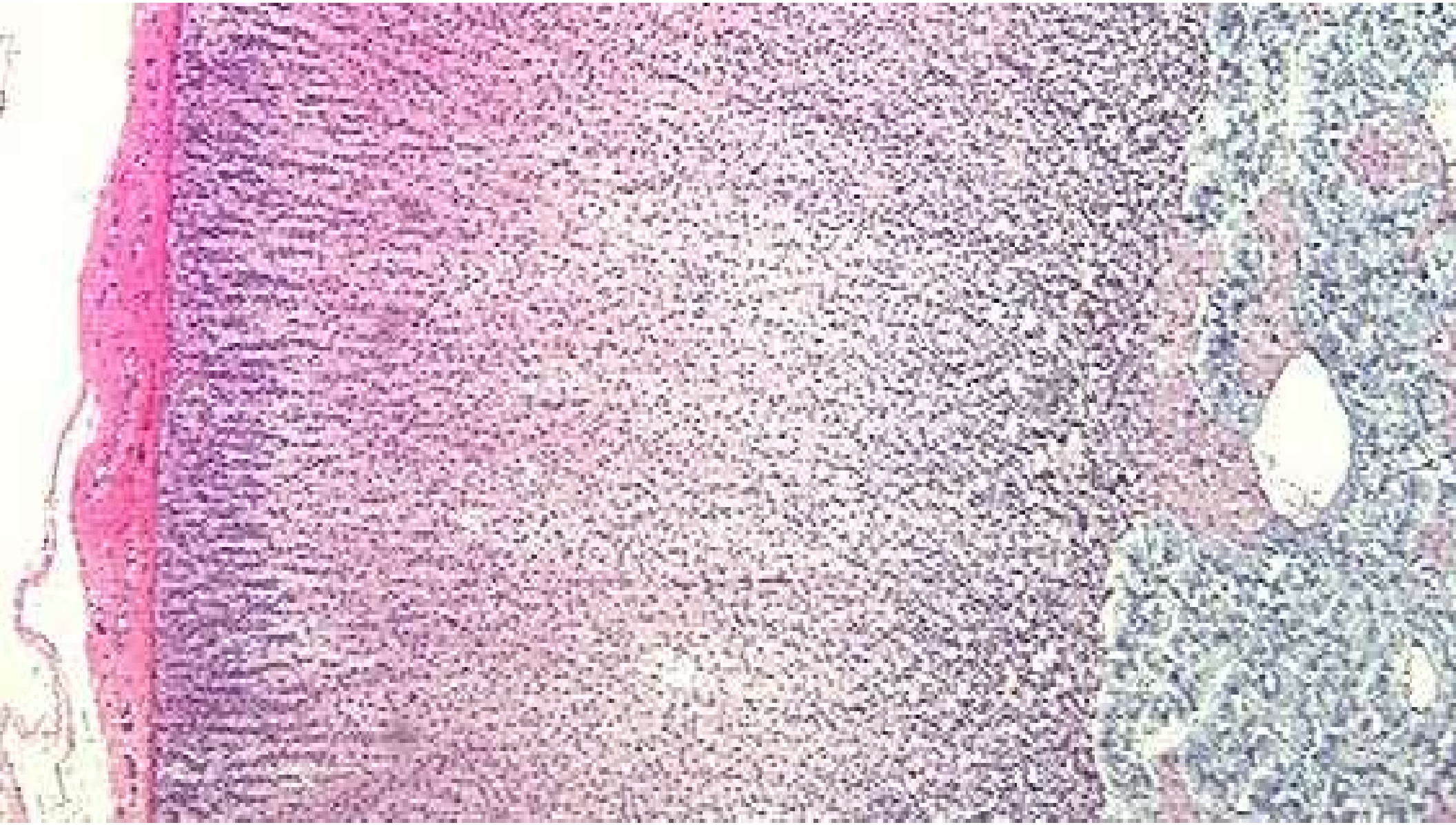

Posterior Pituitary
1000 µm

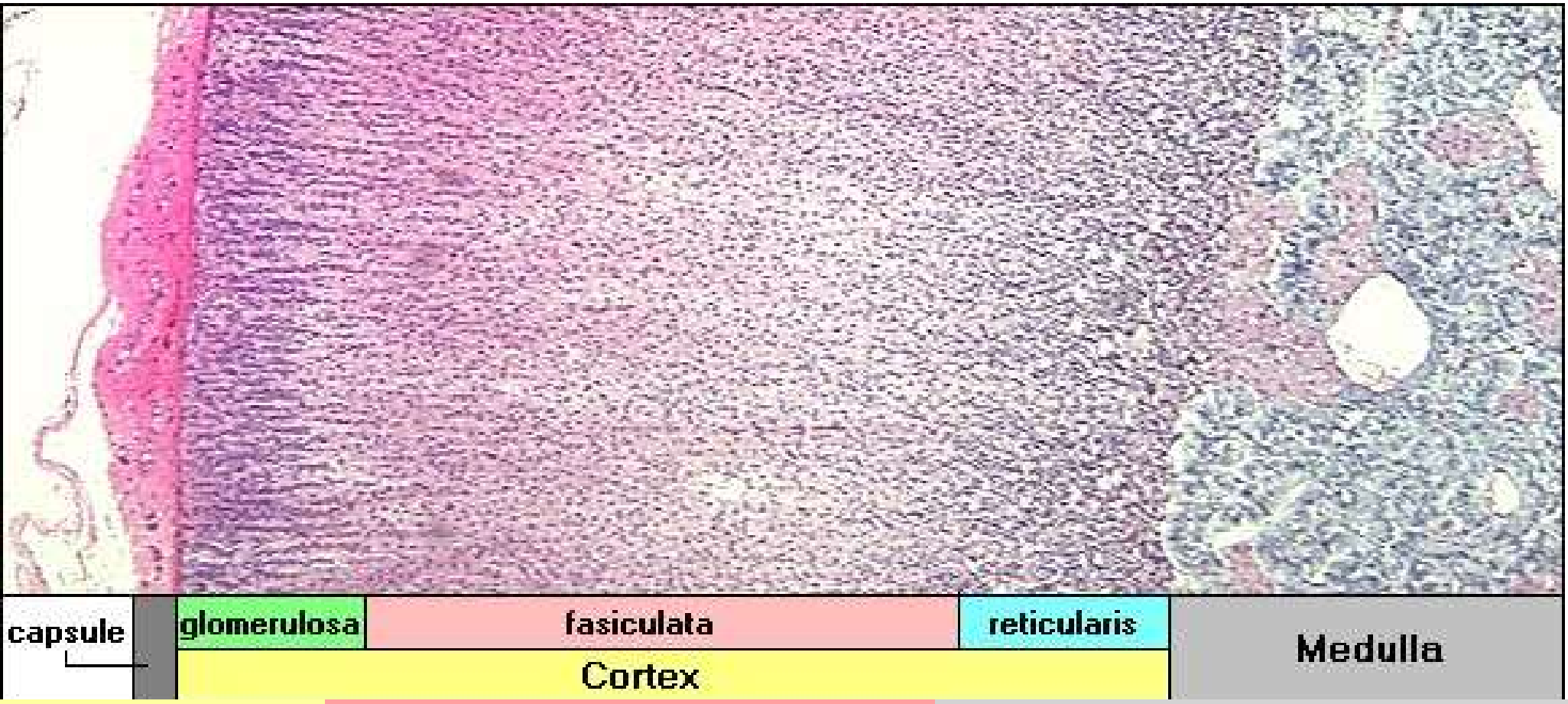

Identify this gland and name these 2 cells



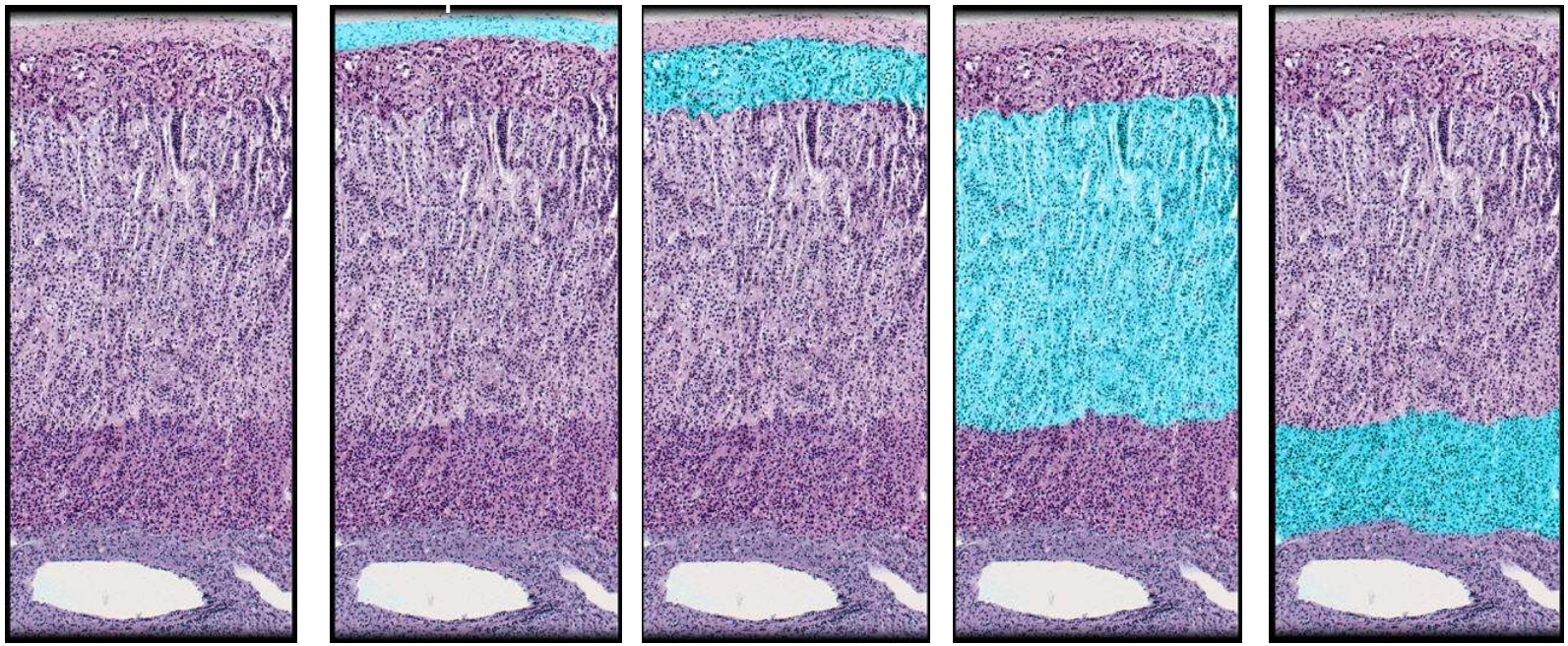
Parathyroid glnd

Adrenal (Suprarenal) Glands

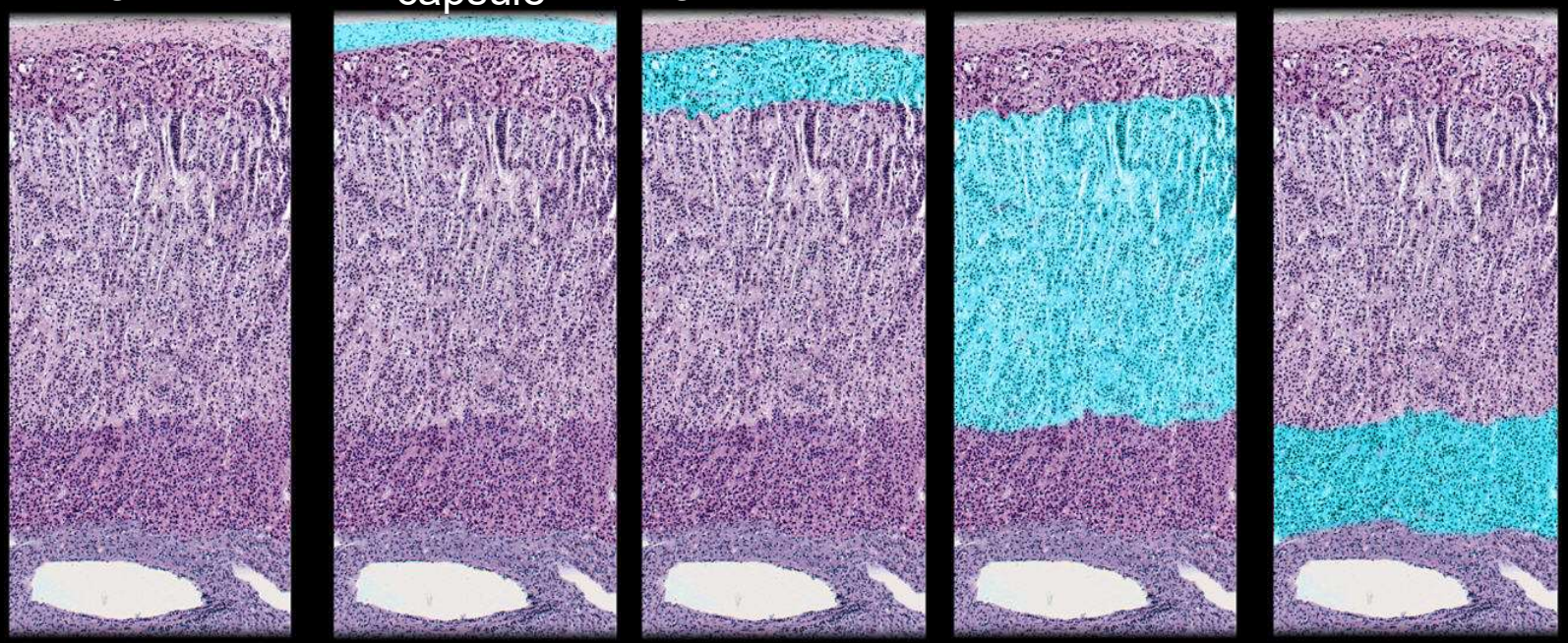




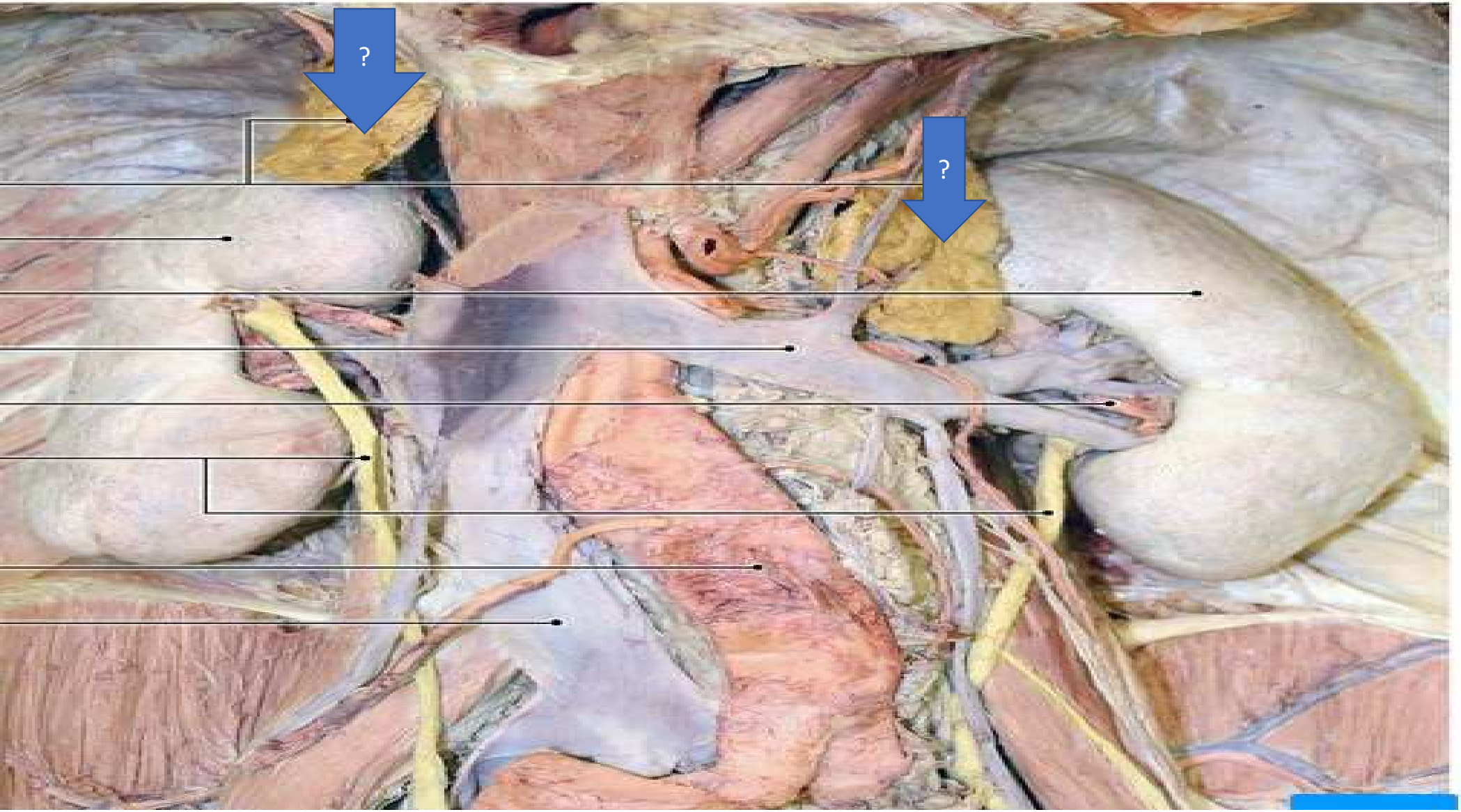
Cortex	zona glomerulosa	mineralocorticoids (aldosterone)
	zona fasiculata	glucocorticoids (cortisol)
	zona reticularis	sex steroids (androgens)
Medulla		catecholamines (epinephrine and norepinephrine)

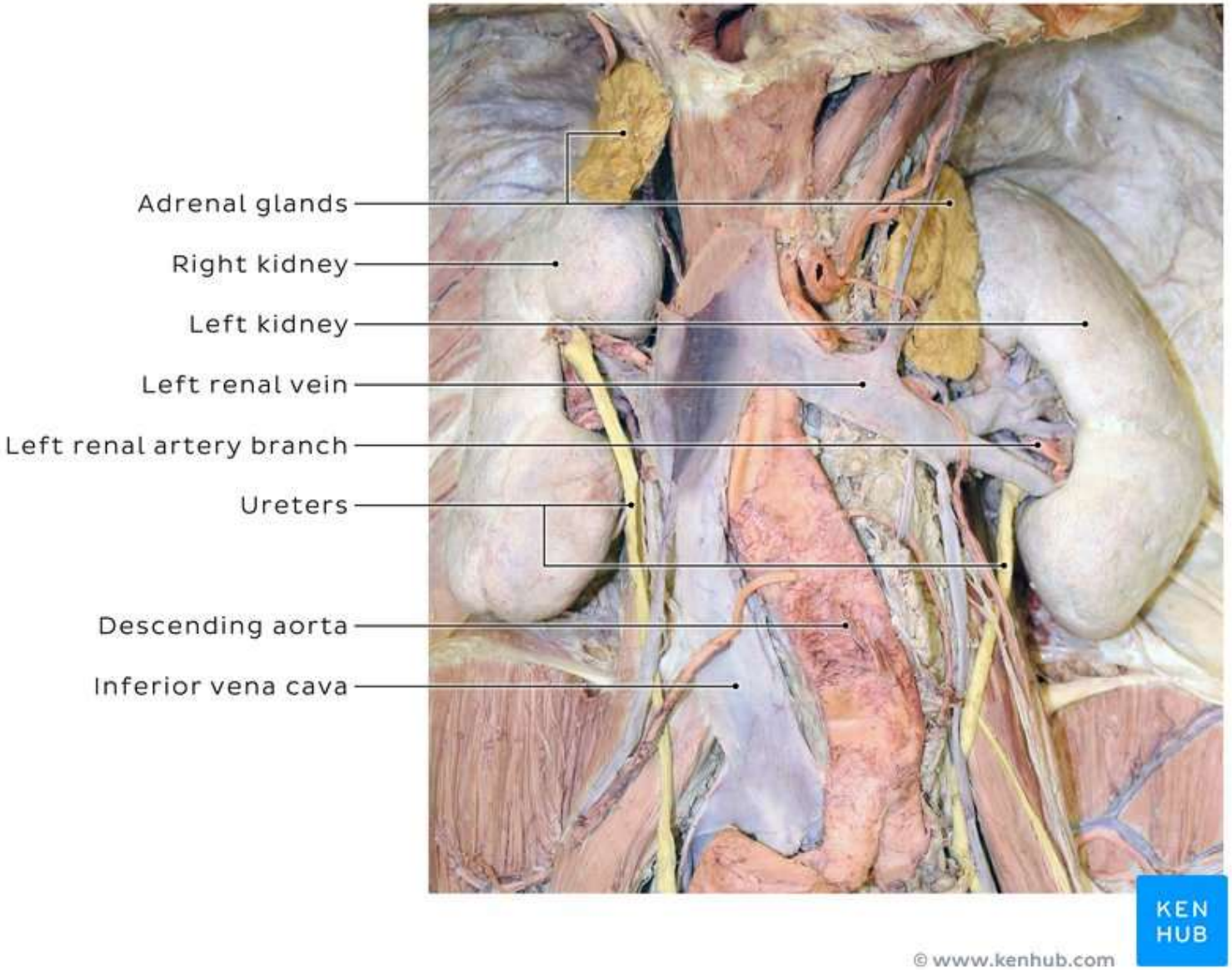


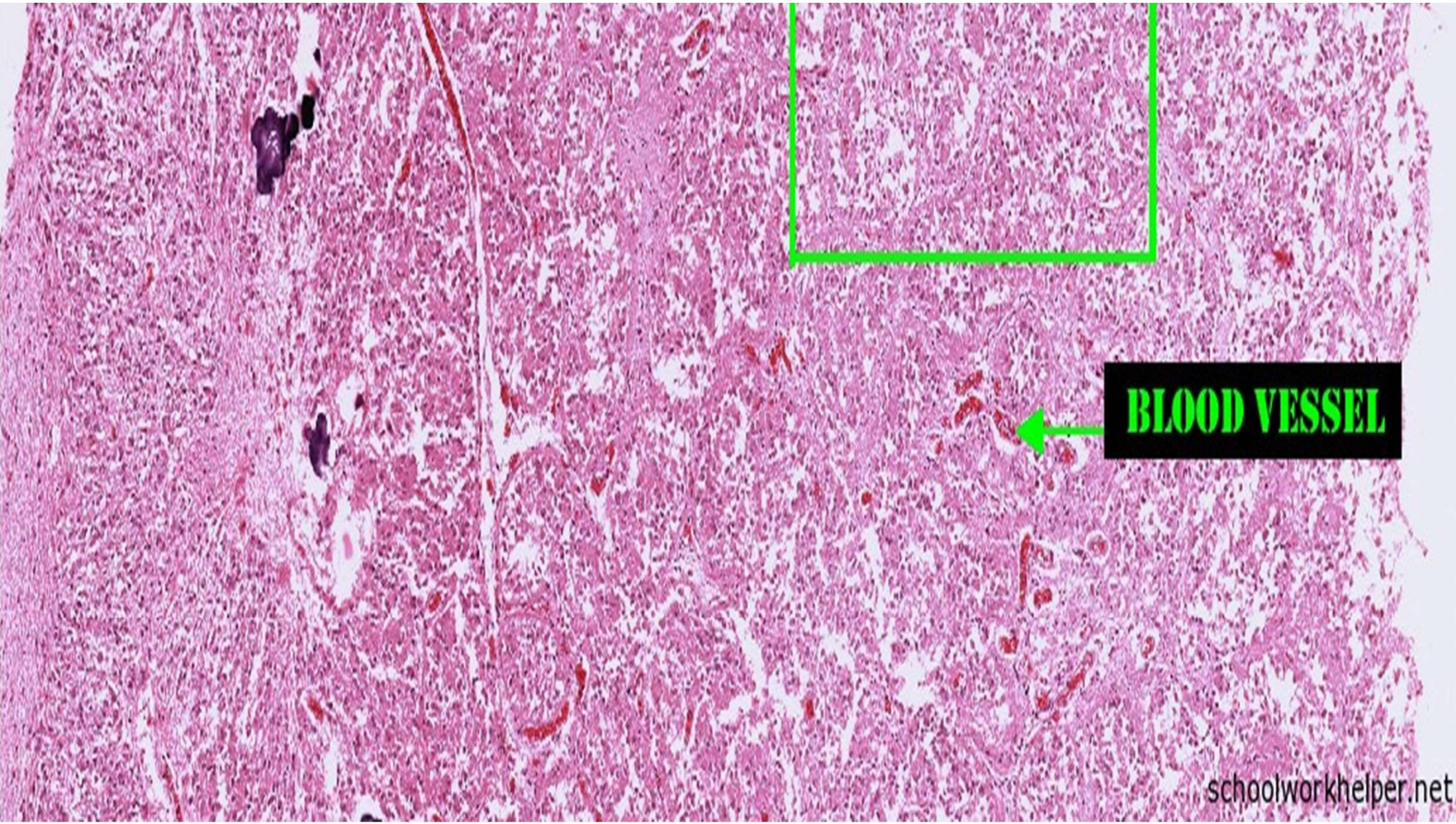
Adrenal Histology



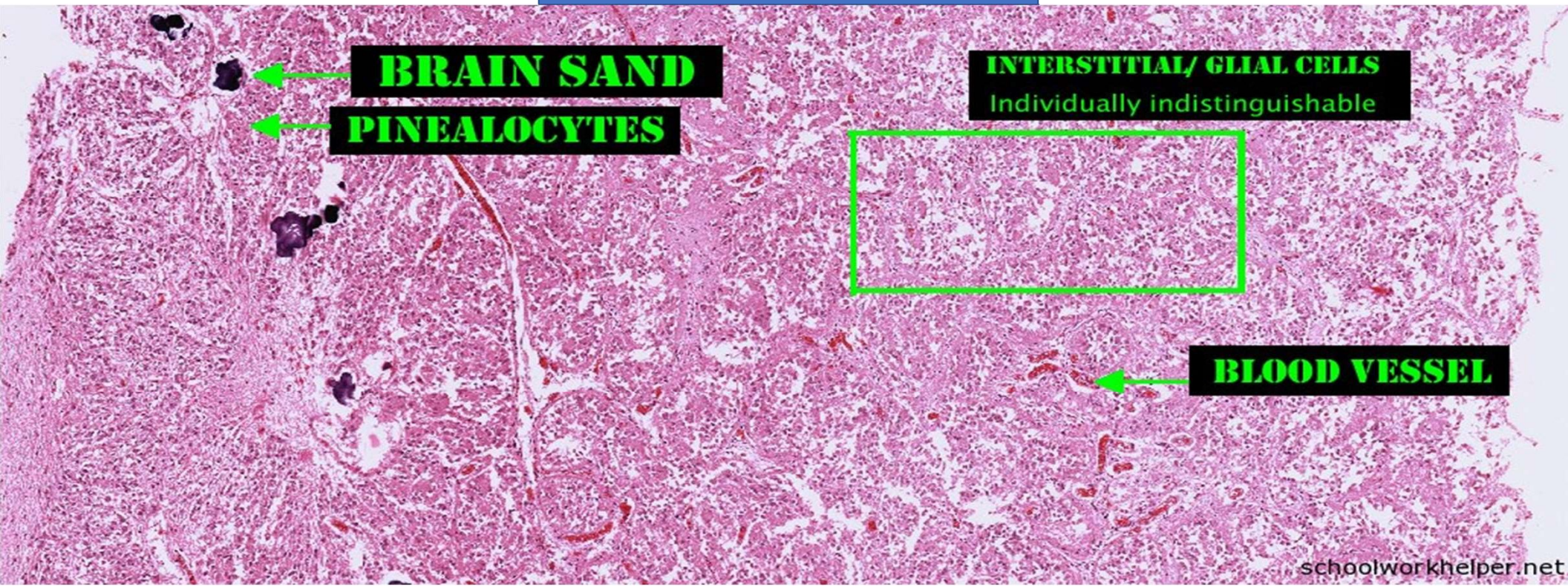
Adrenal gland

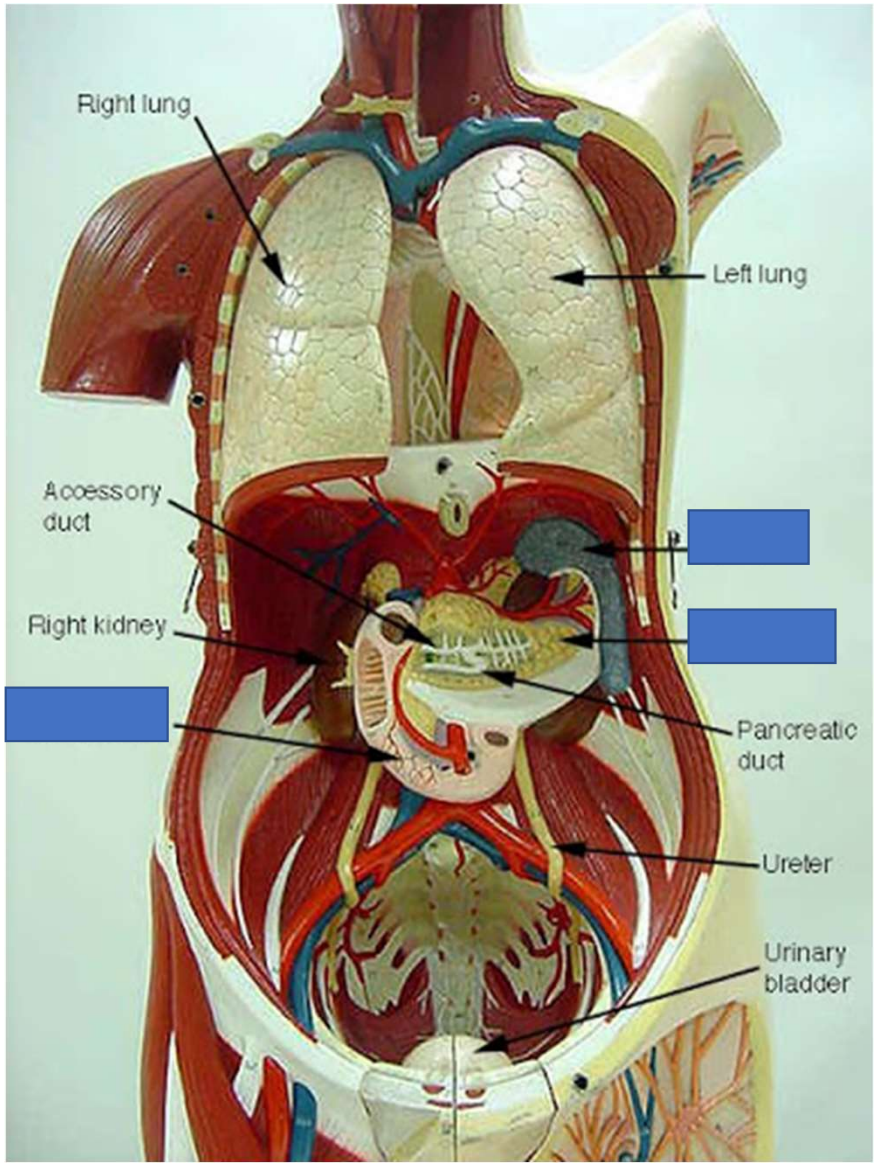


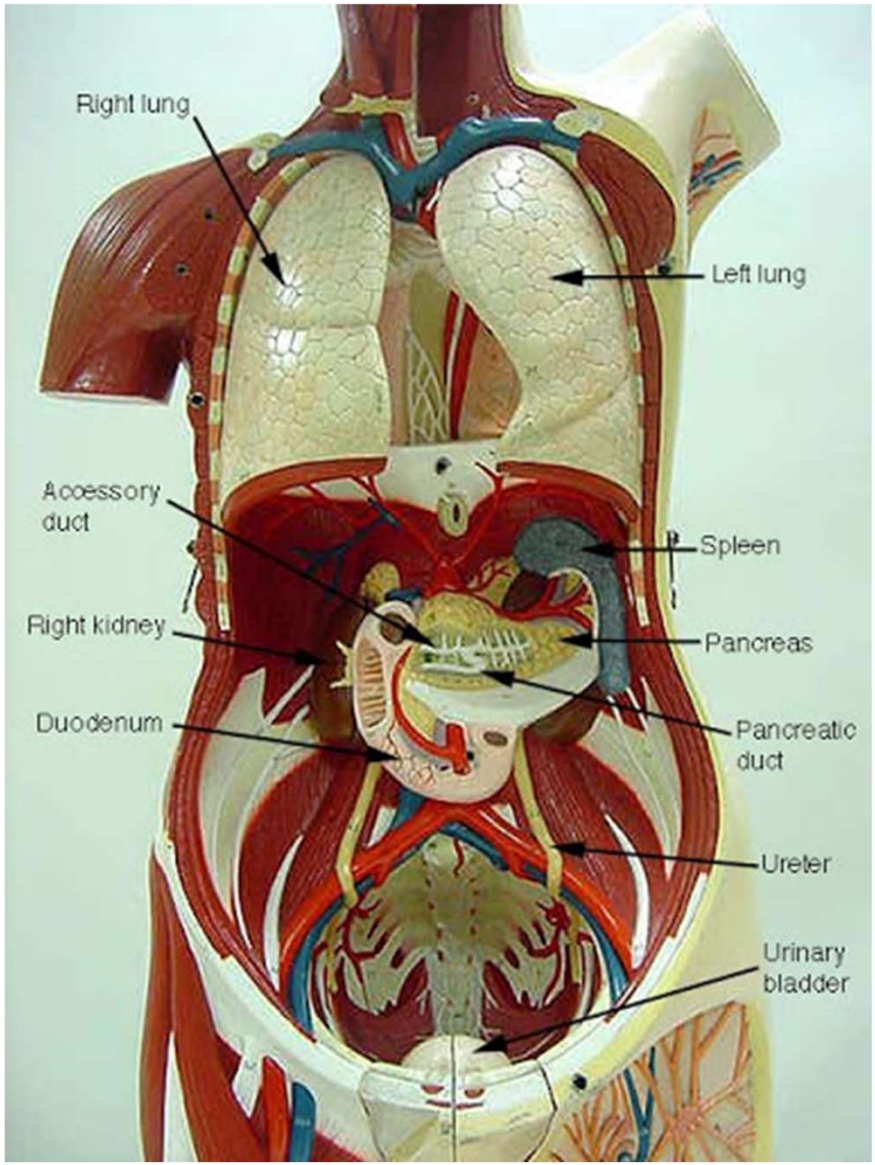


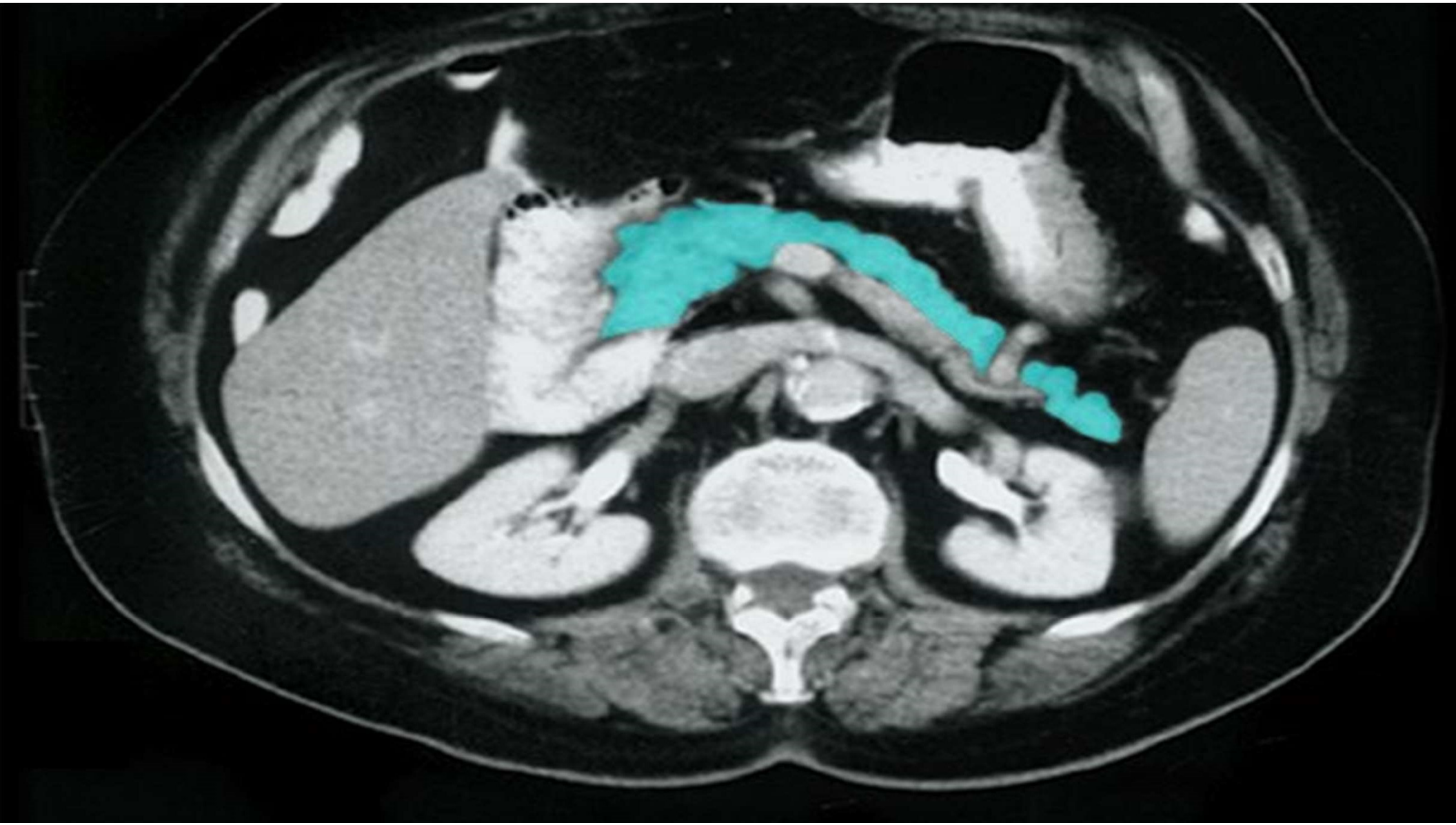

BLOOD VESSEL
schoolworkhelper.net

Pineal gland

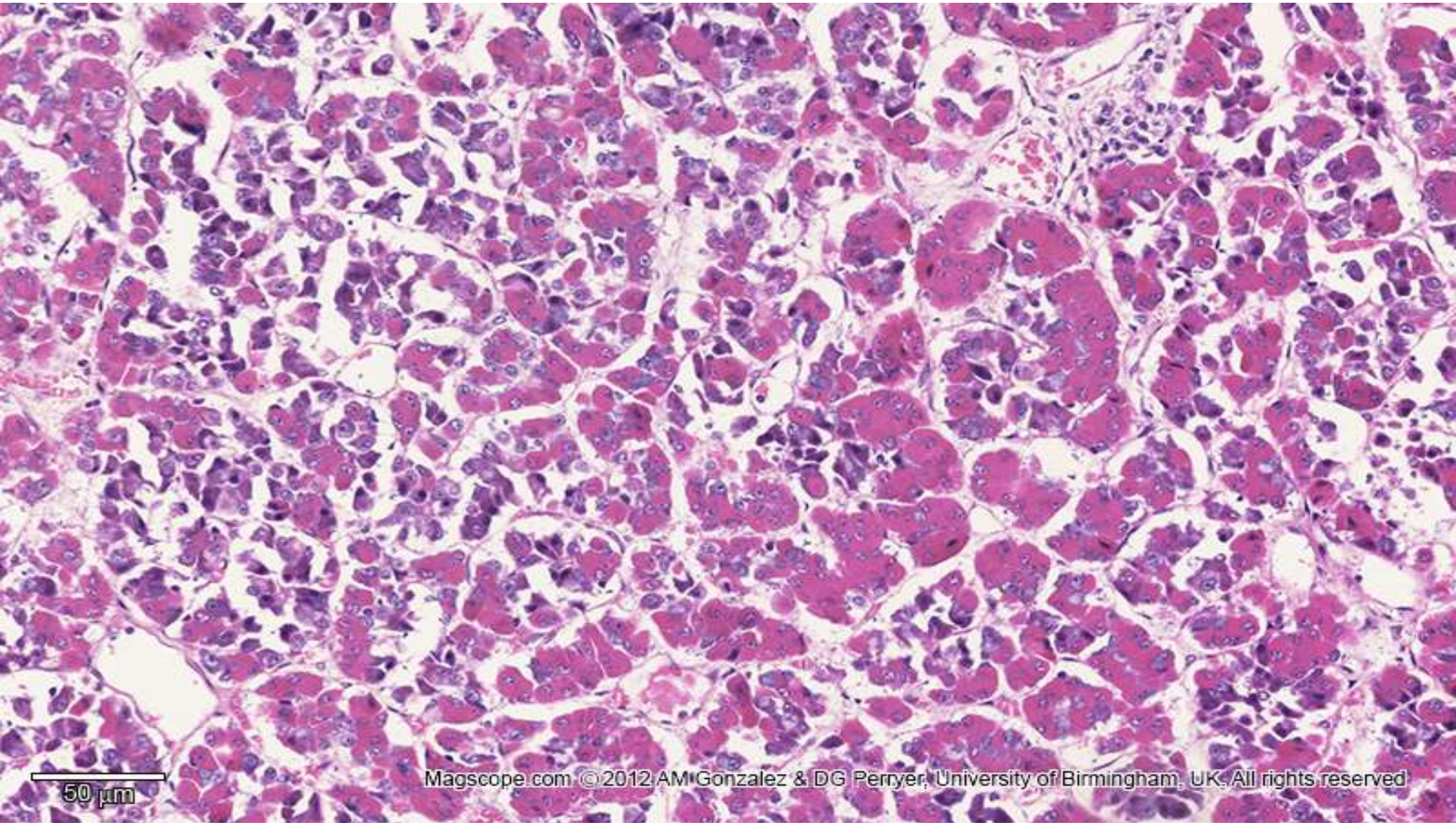



Right lung
Left lung
Accessory duct
Right kidney
Pancreatic duct
Ureter
Urinary bladder

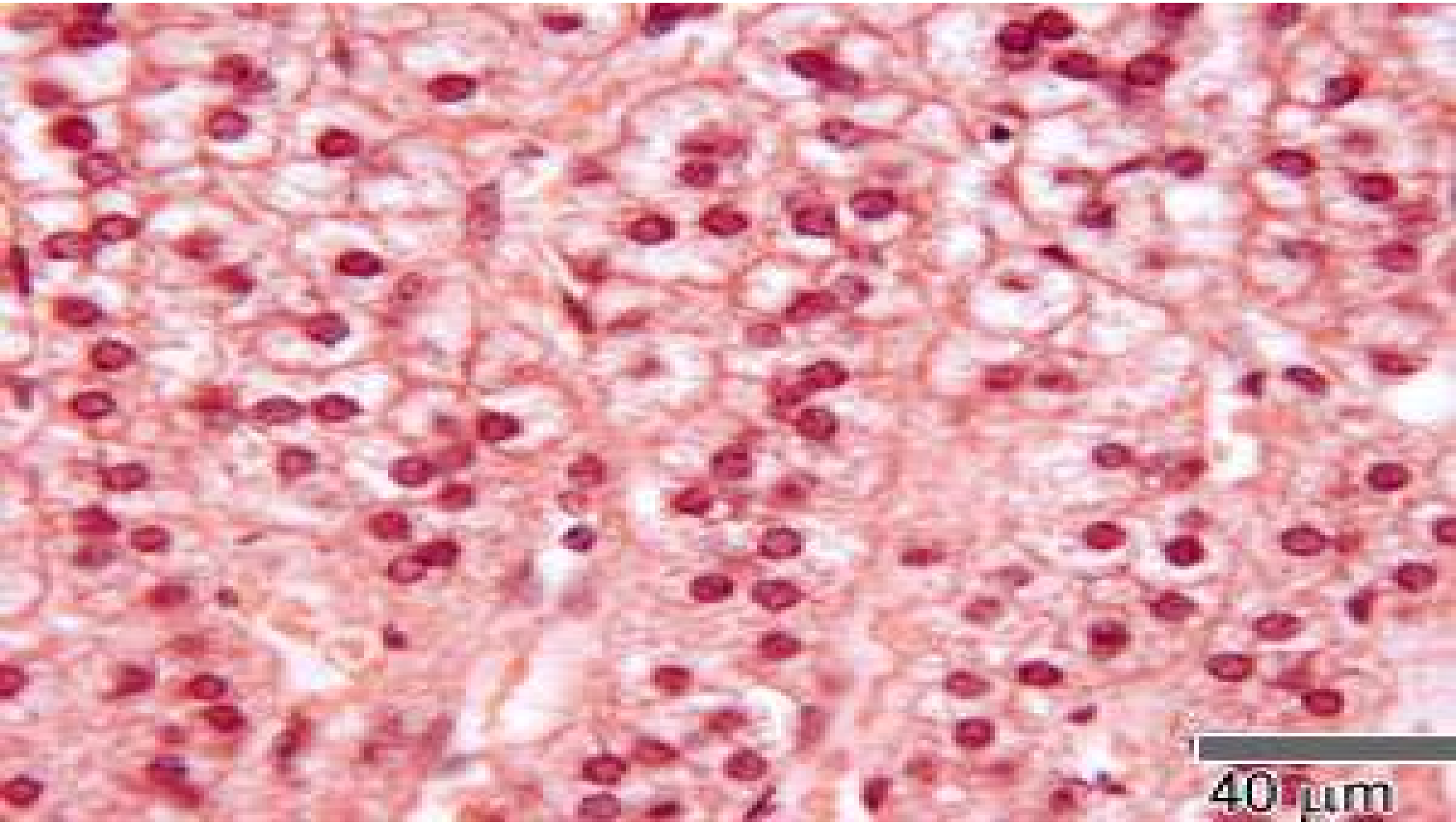

Right lung
Left lung
Accessory duct
Spleen
Right kidney
Pancreas
Duodenum
Pancreatic duct
Ureter
Urinary bladder




PANCREAS



Pituitary anterior


40 µm

Zona fasciculata,

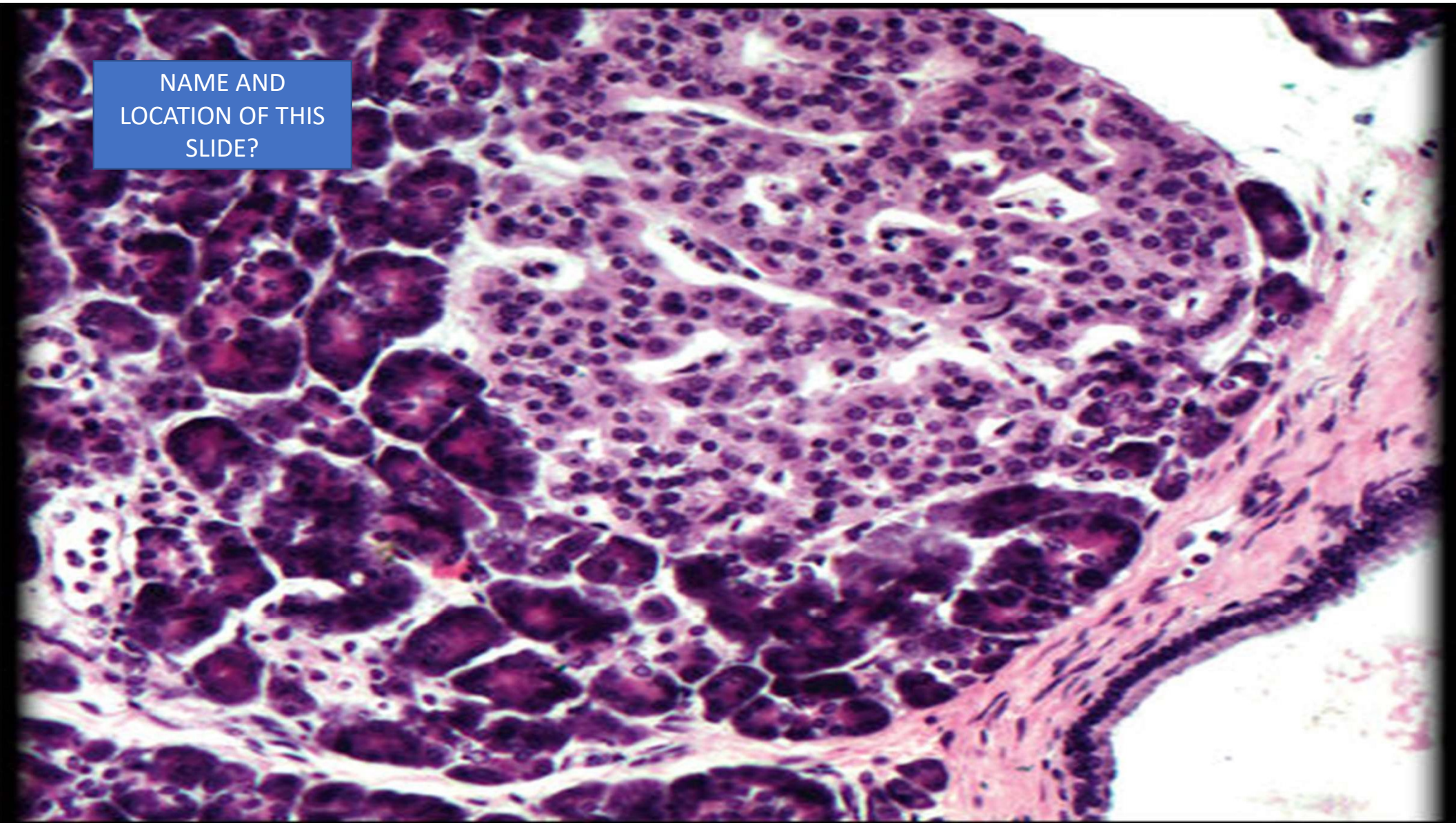
the middle zone of the adrenal cortex secretes glucocorticoids which are important for carbohydrate, protein and lipid metabolism. An example is cortisol which raises blood glucose and cellular synthesis of glycogen. Its secretion is controlled by a hormone from the pituitary - ACTH.

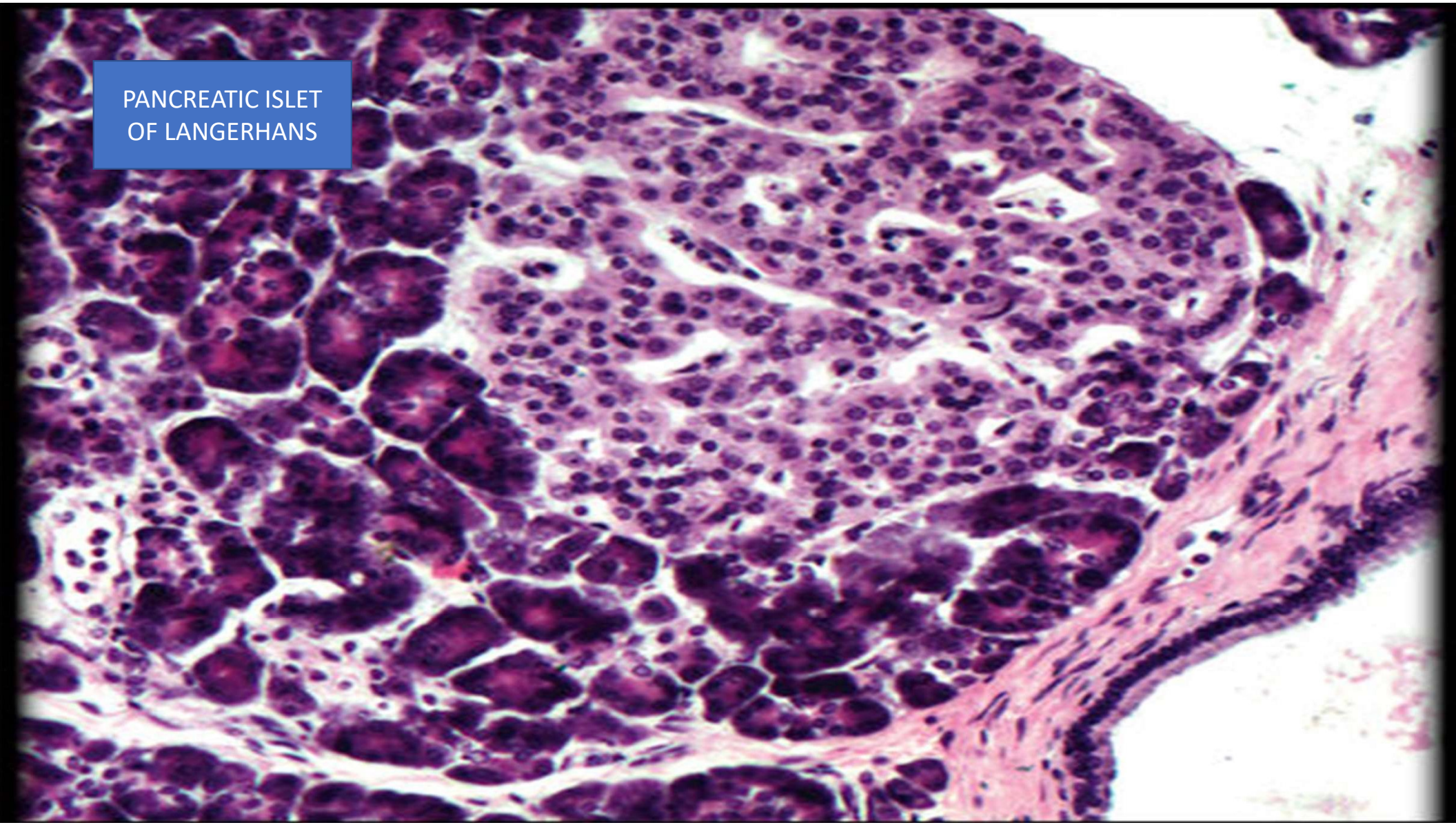
The secretory cells are arranged in cords, often one cell thick, surrounded by fine strands of supporting tissue. Can you identify them?

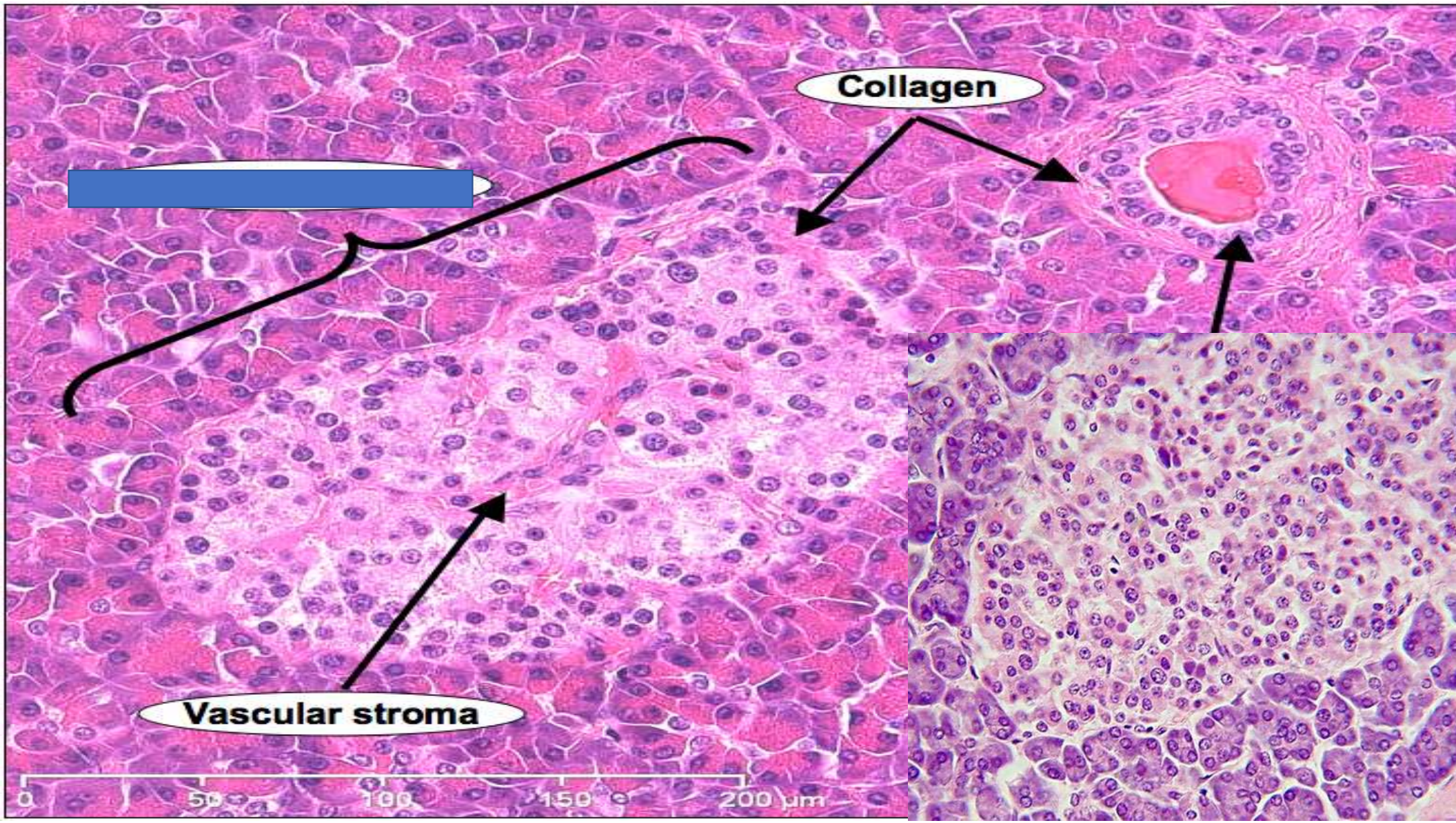
The nuclei of these cells stain strongly, and the cytoplasm is rich in sER, mitochondria and lipid droplets. The cytoplasm looks pale and 'foamy' due to the presence of lipid droplets.

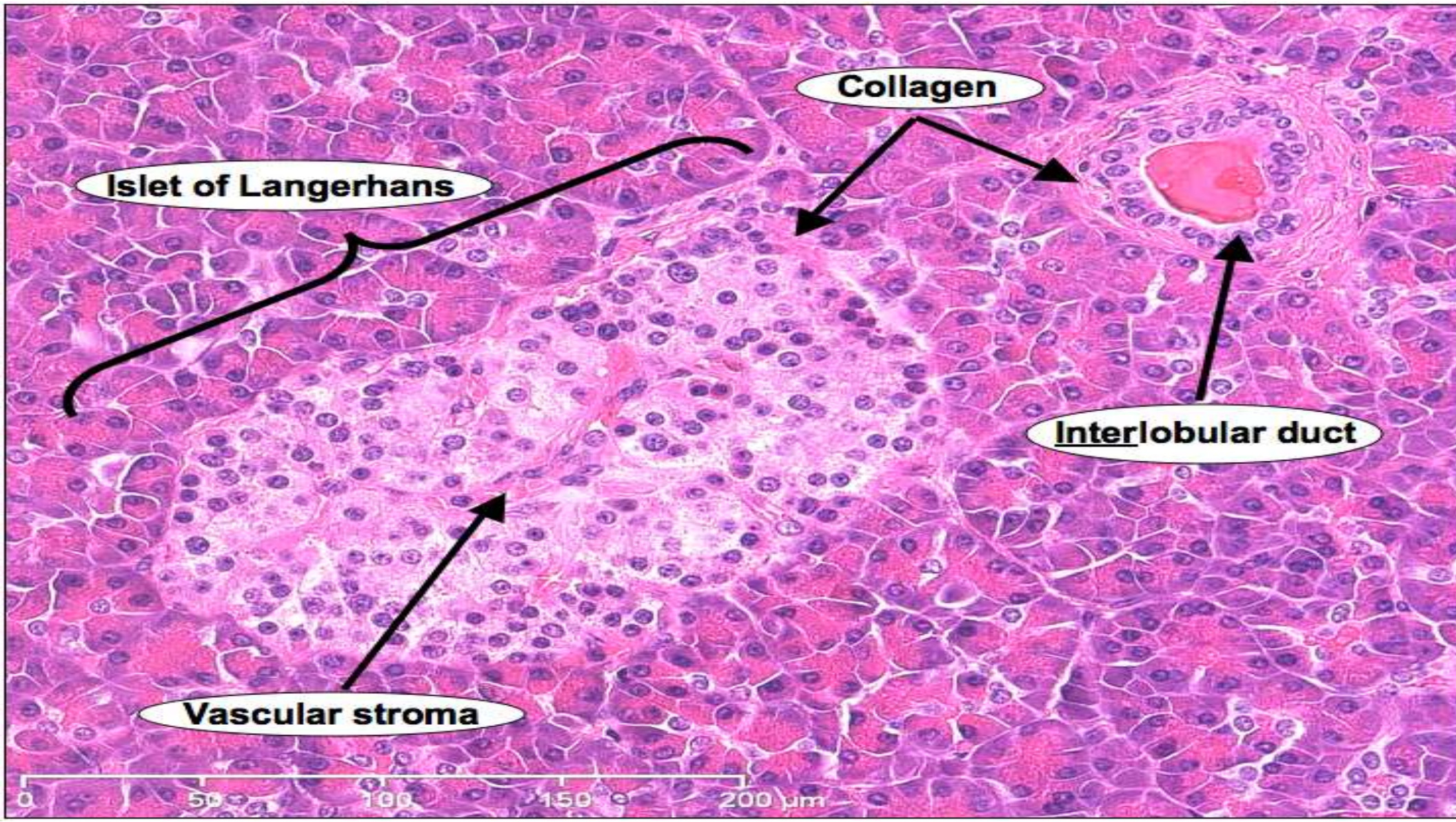
The morphological zonation of the cortex reflects a functional zonation in that

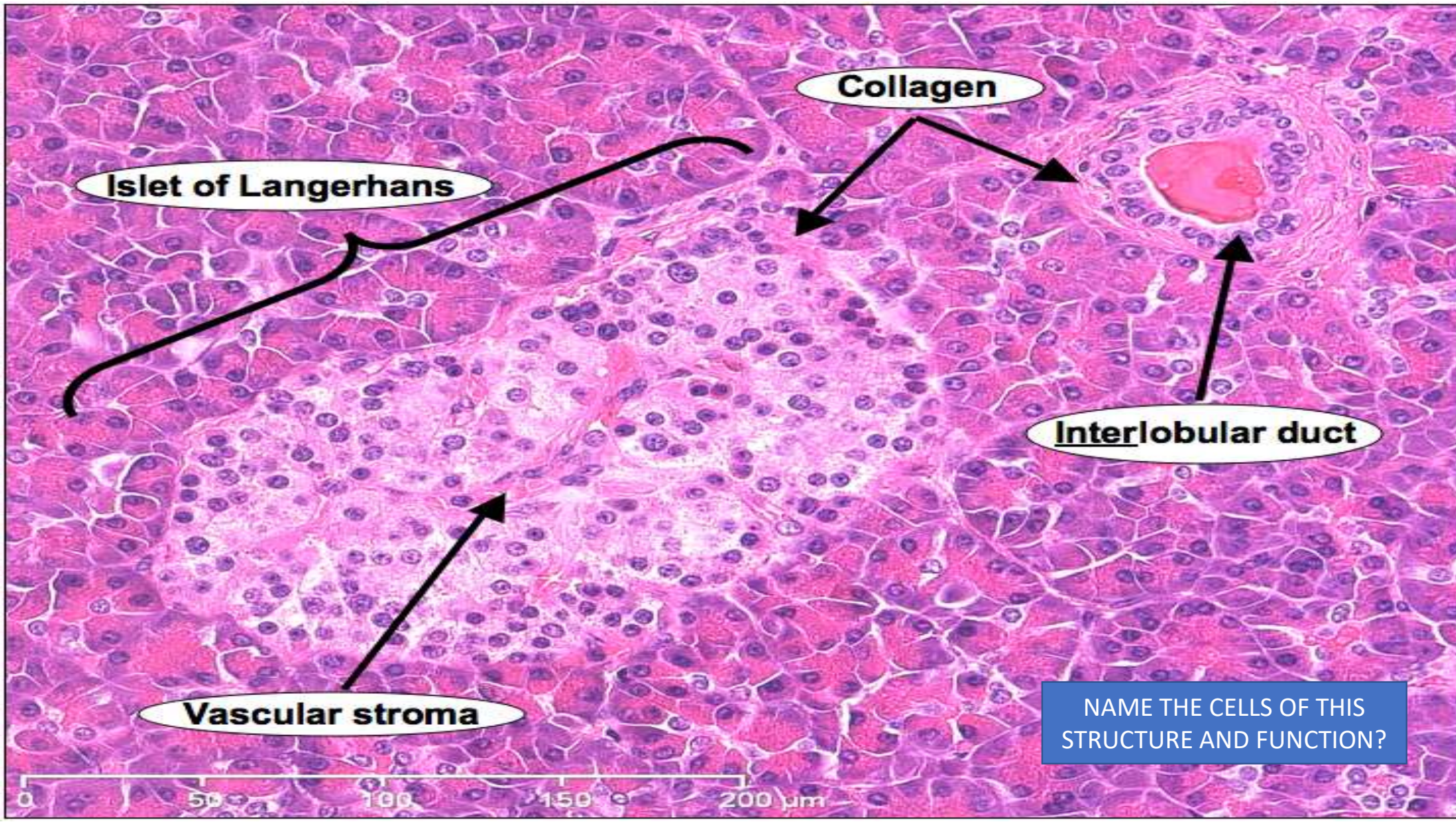
1. **mineralocorticoids are produced in the zona glomerulosa,**
2. **glucocorticoids are produced in the zona fascicularis and reticularis, and**
3. **sex hormones are produced in the zona reticularis**.

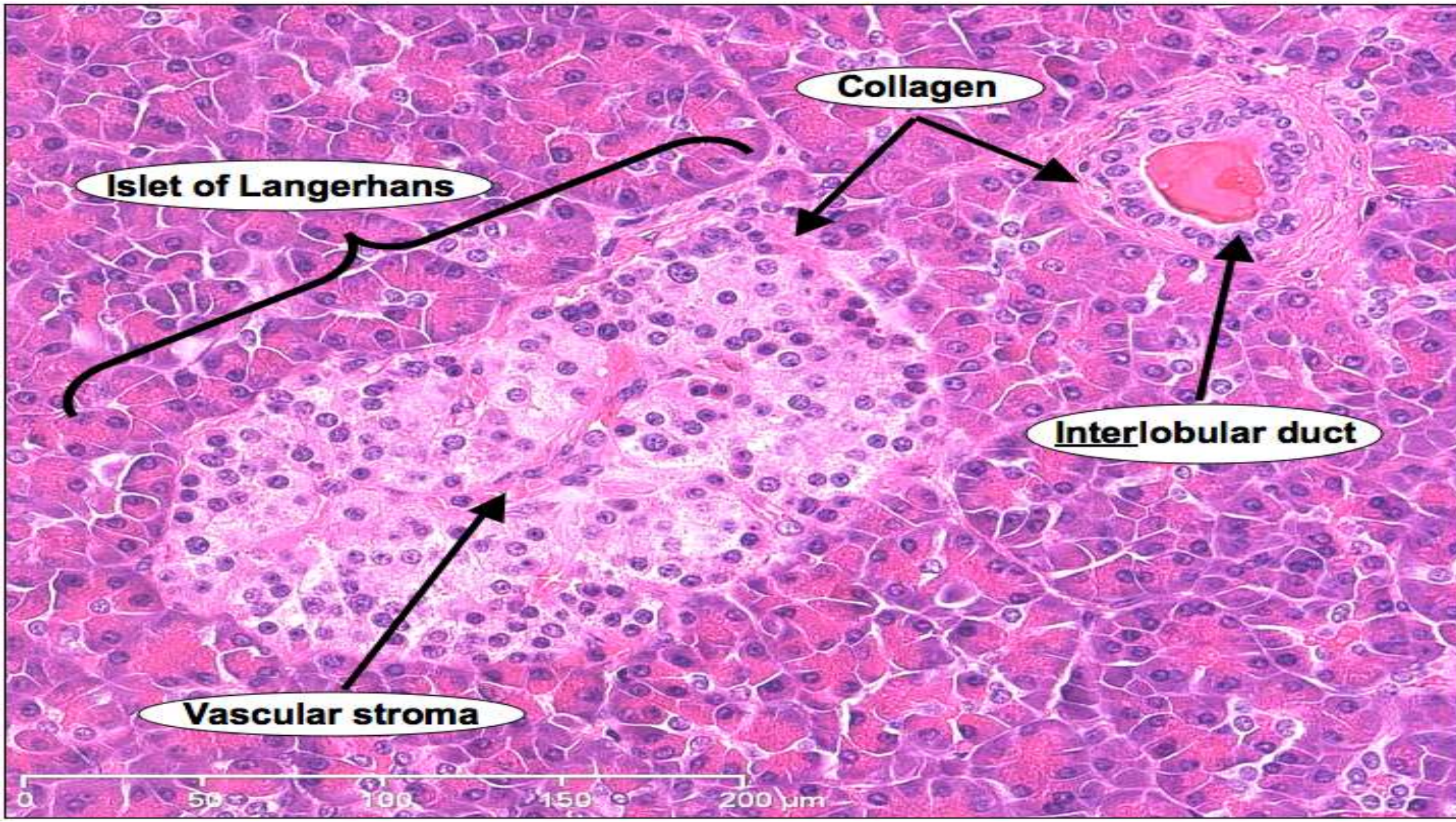

NAME AND
LOCATION OF THIS
SLIDE?


PANCREATIC ISLET
OF LANGERHANS


Collagen
Vascular stroma
0
50
100
150
200 µm


Collagen
Islet of Langerhans
Interlobular duct
Vascular stroma
0
50
100
150
200 µm


Collagen
Islet of Langerhans
Interlobular duct
Vascular stroma
NAME THE CELLS OF THIS STRUCTURE AND FUNCTION?
0
50
100
150
200 µm


Collagen
Islet of Langerhans
Interlobular duct
Vascular stroma
0
50
100
150
200 µm

After consuming a banana split, which hormones would be expected to increase?

A
Prolactin

B
Glucagon

C
Insulin

D
Parathyroid Hormone

After consuming a banana split, which hormones would be expected to increase?

A
Prolactin

B
Glucagon

C
Insulin

D
Parathyroid Hormone

After having a double-bacon cheeseburger with a milkshake, which of the following hormones would NOT be expected to increase?

A. Secretin

B. Insulin

C. Cholecystokinin

A. Glucagon

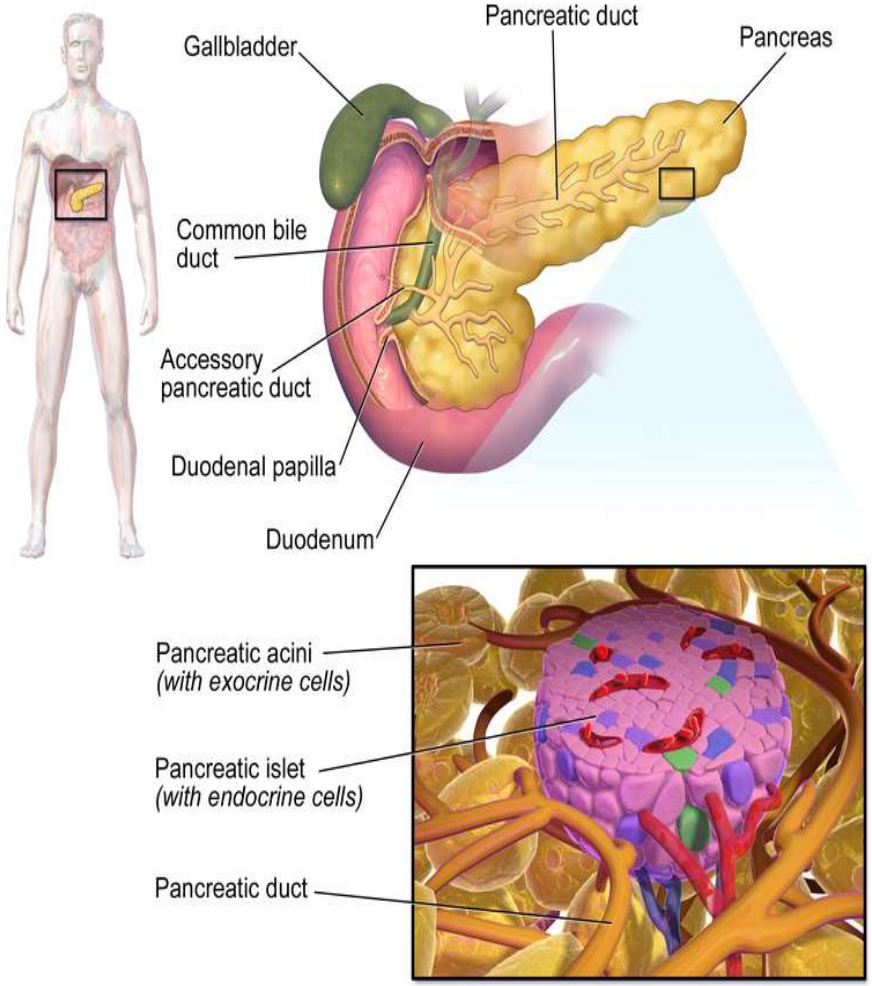
After having a double-bacon cheeseburger with a milkshake, which of the following hormones would NOT be expected to increase?

A. Secretin

B. Insulin

C. Cholecystokinin

D. Glucagon



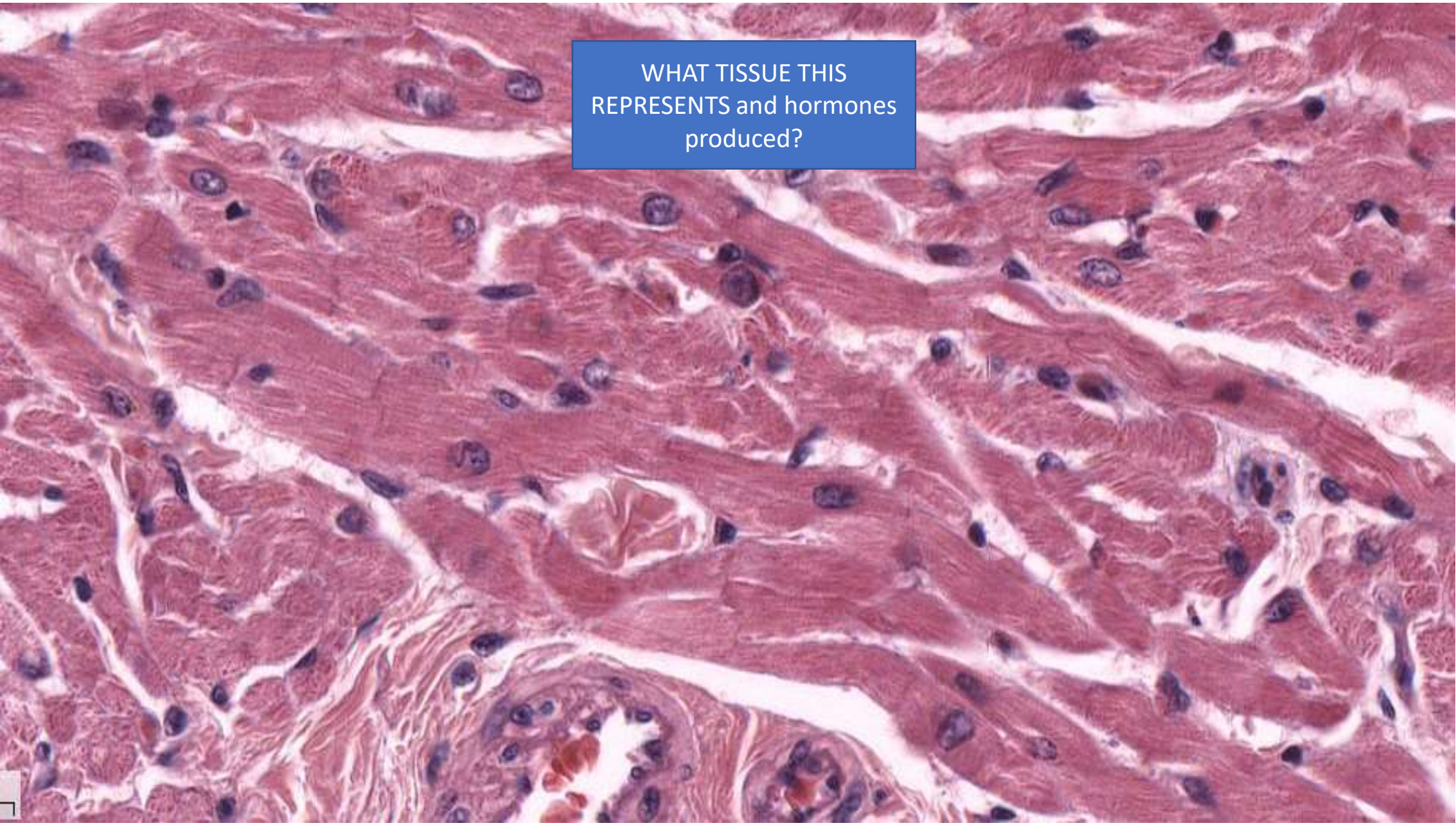
Pancreatic Tissue

Hormones produced in the pancreatic islets are secreted directly into the blood flow by (at least) five types of cells. In rat islets, endocrine cell types are distributed as follows:

- Alpha cells producing glucagon (20% of total islet cells)
- Beta cells producing insulin and amylin (≈70%)
- Delta cells producing somatostatin (<10%)

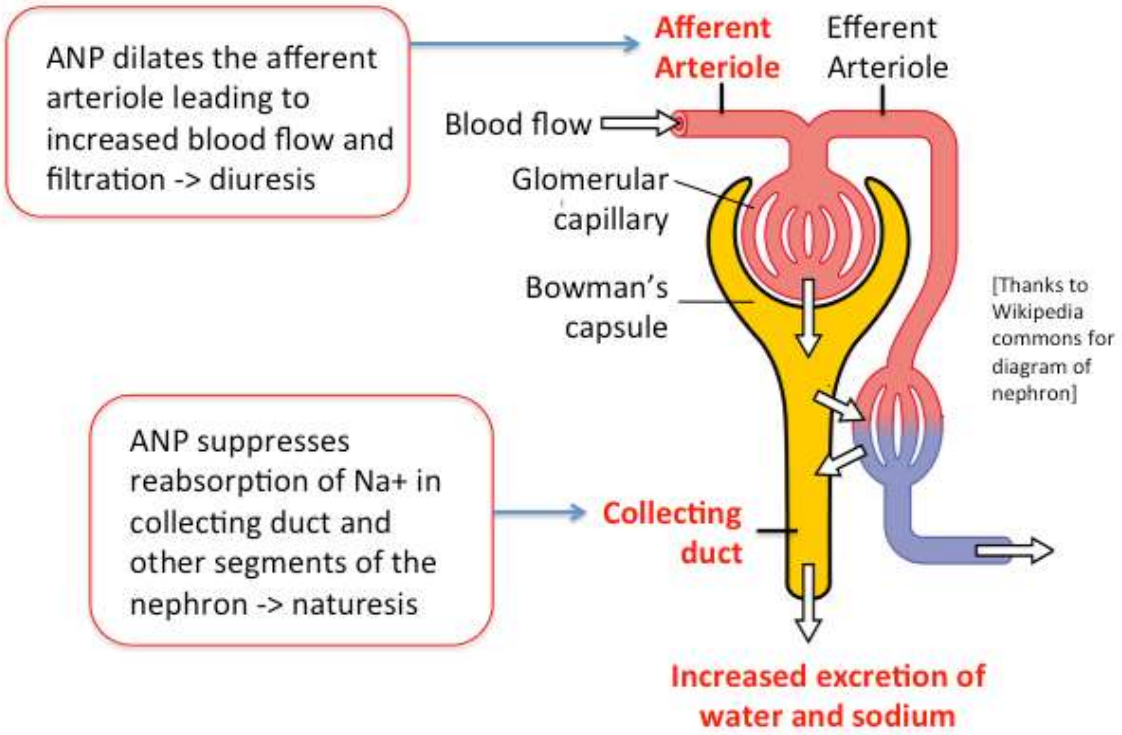
- **Epsilon cells** producing ghrelin (<1%)
- PP cells (gamma cells or F cells) producing pancreatic polypeptide (<5%)

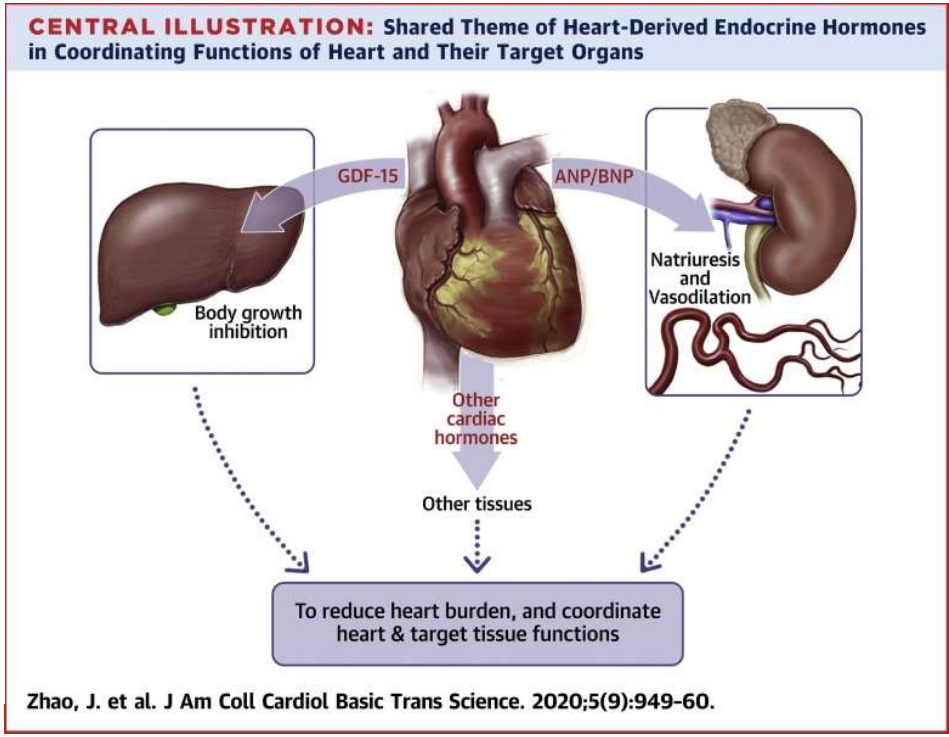
- Glucose/Insulin: activates beta cells and inhibits alpha cells
- Glycogen/Glucagon: activates alpha cells which activates beta cells and delta cells
- Somatostatin: inhibits alpha cells and beta cells

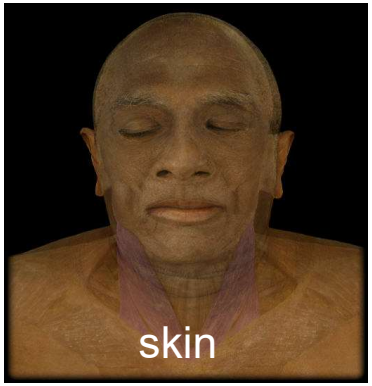

WHAT TISSUE THIS REPRESENTS and hormones produced?

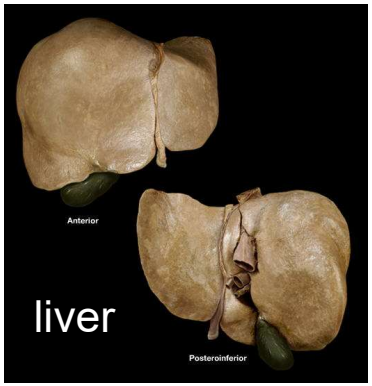
The heart , ANP, BNP, CNP hormones and others

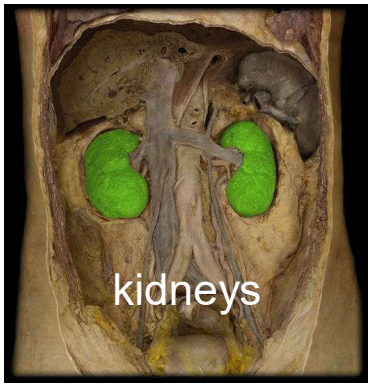
atrial natriuretic peptide (ANP), brain (or B-type) natriuretic peptide (BNP), and C-type natriuretic peptide (CNP)






skin

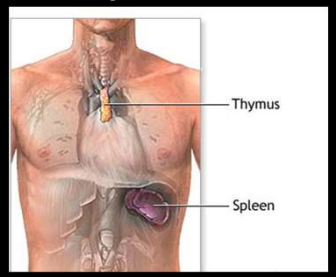

Anterior
liver
Posteroinferior


kidneys

Other Organs with Endocrine Function

Histamine
Insulin-like Growth Factors
Leptin
Pineal Gland and Melatonin
Renin-Angiotensin System
Somatostatin
Vitamin D (Calcitriol)
Gastrin,
ghreline

thymosin



calcitriol

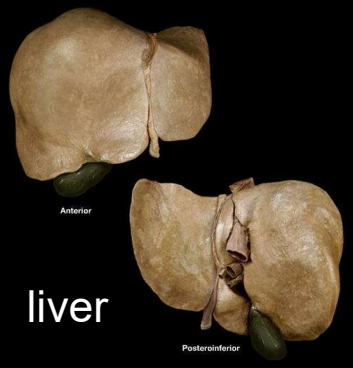
erythropoietin

angiotensin II

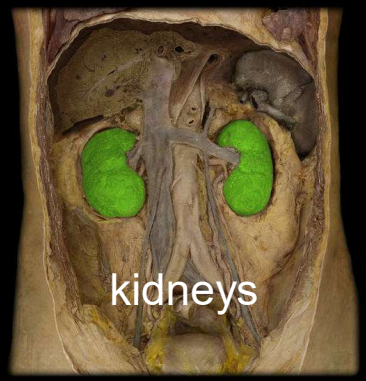
calcitriol

IGF-1

hepcidin



liver



EPO

Angiotensin

calcitriol

Hormonal signaling involves the following steps?

Hormonal signaling involves the following steps?

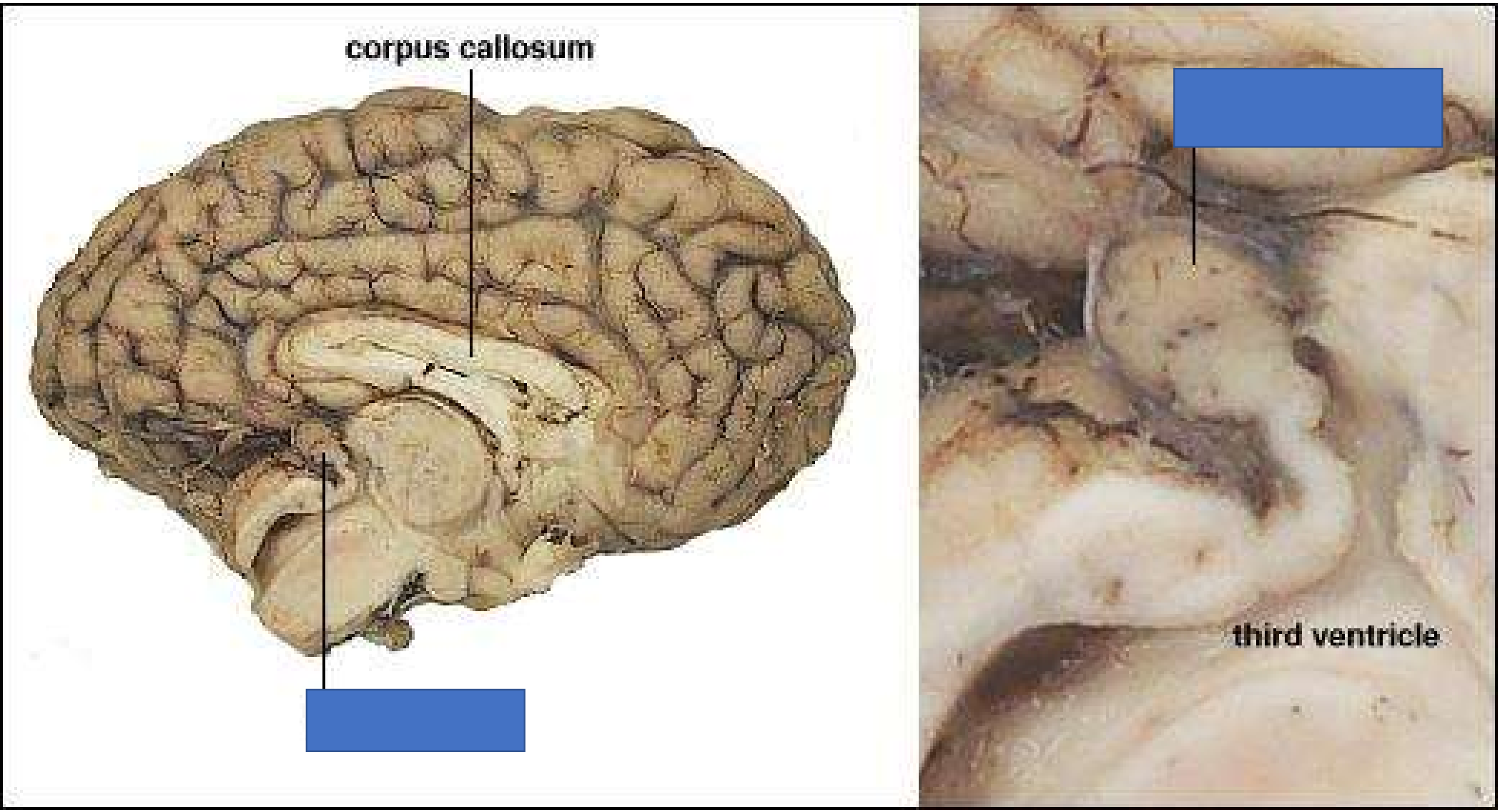
1. **Biosynthesis** of a particular hormone in a particular tissue.
2. **Storage and secretion** of the hormone.
3. **Transport** of the hormone to the target cell(s).
4. **Recognition** of the hormone by an associated cell membrane or intracellular receptor protein.
5. **Relay and amplification** of the received hormonal signal via a signal transduction process: This then leads to a cellular response. The reaction of the target cells may then be recognized by the original hormone-producing cells, leading to a downregulation in hormone production. This is an example of a homeostatic negative feedback loop.
6. **Breakdown** of the hormone.

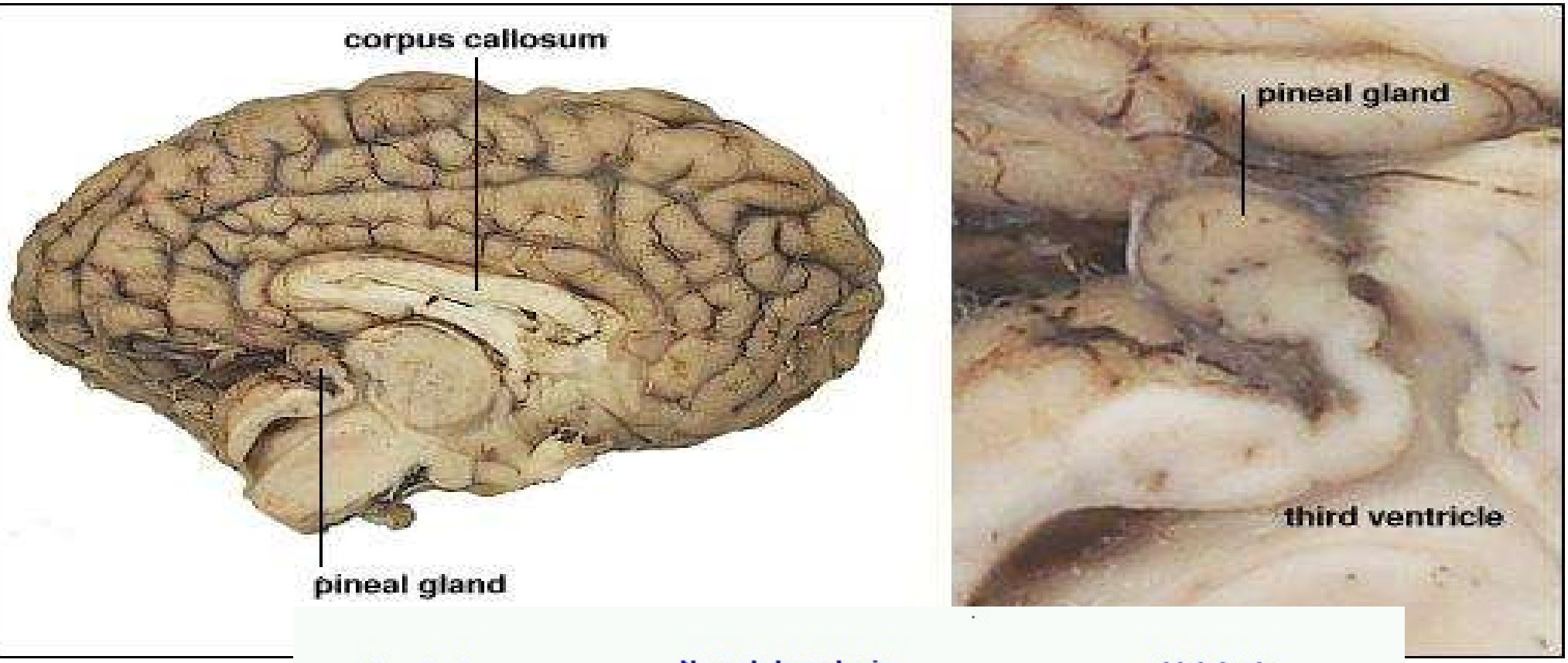
Signaling Types - Hormones		
SN	Types	Description
1	Endocrine	Acts on the target cells after being released into the bloodstream.
2	Paracrine	Acts on the nearby cells and does not have to enter general circulation.
3	Autocrine	Affects the cell types that secreted it and causes a biological effect.
4	Intracrine	Acts intracellularly on the cells that synthesized it.

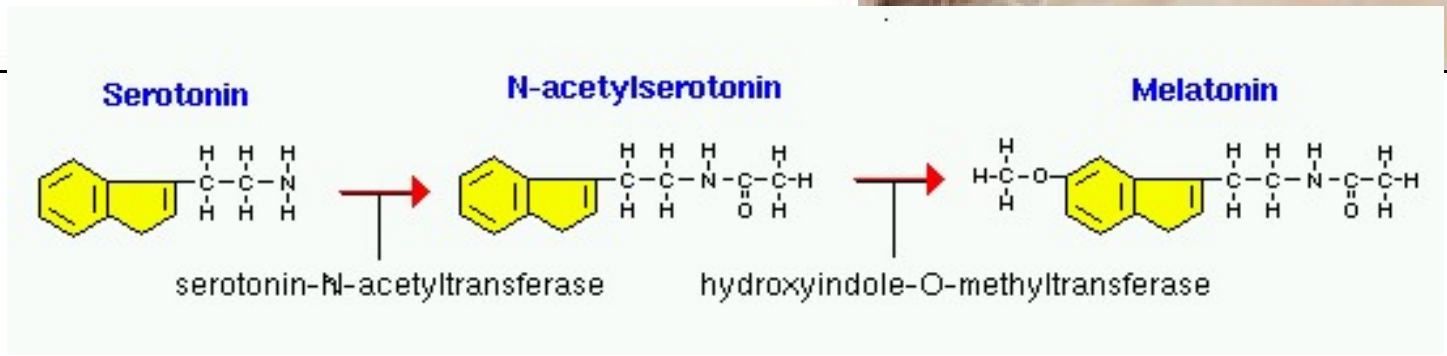
Signaling Types - Hormones		
SN	Types	Description and definition
1	Endocrine	?
2	Paracrine	?
3	Autocrine	?
4	Intracrine	?

Hormones have what effects on the body?

Hormones have the following effects on the body:
•stimulation or inhibition of growth
•wake-sleep cycle and other circadian rhythms
•mood swings
•induction or suppression of apoptosis (programmed cell death)
•activation or inhibition of the immune system
•regulation of metabolism
•preparation of the body for mating, fighting, fleeing, and other activity
•preparation of the body for a new phase of life, such as puberty, parenting, and menopause
•control of the reproductive cycle
•hunger cravings
A hormone may also regulate the production and release of other hormones.
Hormone signals control the internal environment of the body through homeostasis.


corpus callosum
third ventricle


corpus callosum
pineal gland
pineal gland
third ventricle


Serotonin
N-acetylserotonin
Melatonin
serotonin-N-acetyltransferase
hydroxyindole-O-methyltransferase

What hormone regulates blood pressure?

a. growth hormone

b. luteinizing hormone

c. ADH

d. Oxytocin

What hormone regulates blood pressure?

a. growth hormone

b. luteinizing hormone

c. ADH

d. Oxytocin

If the pancreas fails to produce insulin, what condition does this lead to?

a. Diabetes mellitus type 2

b. Diabetes mellitus type 1

b. Diabetes mellitus type 1

The "fight or flight" response is an example of what kind of stimulus?

a. hormonal

b. humoral

c. neural

The "fight or flight" response is an example of what kind of stimulus?

a. hormonal

b. humoral

c. neural

As oxytocin stimulates the uterus to contract, further secretion of oxytocin ensues. What is this process called?

a. positive feedback loop

b. negative feedback loop

As oxytocin stimulates the uterus to contract, further secretion of oxytocin ensues. What is this process called?

a. positive feedback loop

b. negative feedback loop

All hormones are secreted by the anterior pituitary gland except:

a. TSH, ACTH, LH

b. ADH

c. AHH, GH, PL

d. MSH

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a. TSH, ACTH, LH

b. ADH

c. AHH, GH, PL

d. MSH

Which secretory glands are controlled by the anterior lobe via the hypothalamus?

a. adrenal cortex, gonads, thyroid gland

b. hypothalamus, pineal, pituitary

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b. hypothalamus, pineal, pituitary

What hormone allows the kidneys to reabsorb water and return it to the bloodstream to help the body retain as much water?

a. ADTH
b. ACT
c. DHEA
d. ADH

What hormone allows the kidneys to reabsorb water and return it to the bloodstream to help the body retain as much water?

a. ADTH

b. ACT

c. DHEA

d. ADH

What zone in the kidneys release DHEA?

a. Zona glomerulata

b. Zona fasciculata

c. Zona reticularis

What zone in the kidneys release DHEA?

a. Zona glomerulata

b. Zona fasciculata

c. Zona reticularis

What hormone in the kidneys regulates blood volume and pressure?

a. aldosterone

b. cortisol

c. norepinepherine

What hormone in the kidneys regulates blood volume and pressure?

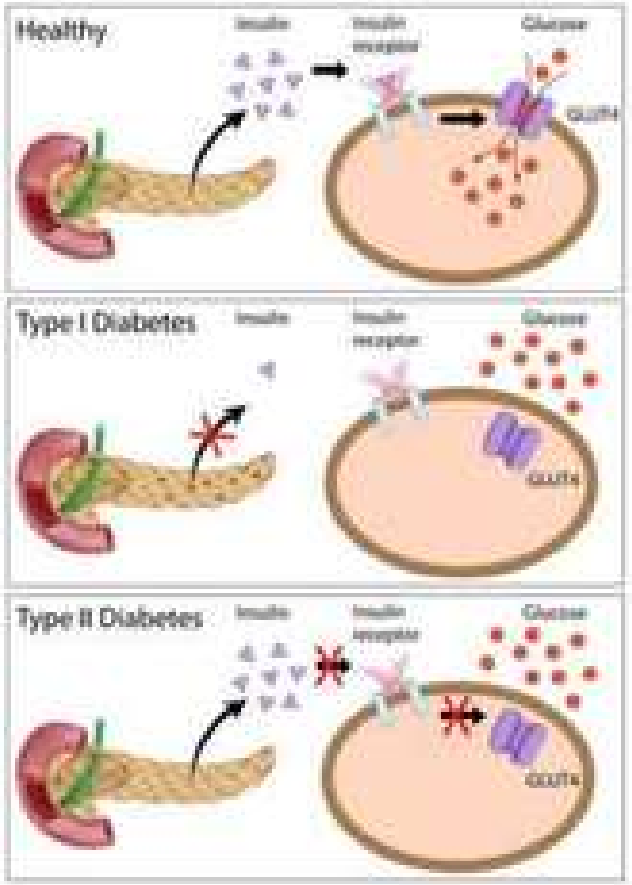
a. aldosterone

b. cortisol

c. norepinepherine

Type 1 vs. Type 2 Diabetes

Comparison of type 1 and 2 diabetes		
Feature	**Type 1 diabetes**	**Type 2 diabetes**
Onset	Sudden	Gradual
Age at onset	Any age (mostly young)	Mostly in adults
Body habitus	Thin or normal	Often obese
Ketoacidosis	Common	Rare
Autoantibodies	Usually present	Absent
Endogenous insulin	Low or absent	Normal, decreased or increased
Concordance in identical twins	50%	90%
Prevalence	Less prevalent	More prevalent - 90 to 95% of U.S. diabetics



Blood

- **Primary**
  - Transportation
  - Exchange
- **Secondary**
  - Immunity
  - Thermoregulation
  - Fluid volume balance
  - pH balance

Blood volume and osmotic pressure are regulated by several negative feedback mechanisms.

Those mechanisms of specific interest involve which hormones?

Blood volume and osmotic pressure are regulated by several negative feedback mechanisms.

Those mechanisms of specific interest involve

- **aldosterone,**
- **ADH**
- ***atrial natriuretic peptide***

A men of 80 kg of weight want to know, how much blood he has?

A men of 80 kg of weight want to know, how much blood he has?

80 kg X 0.08 = 6.4 Kg = 6.4 L

What is the protein plasma composition?

Whole Blood

100%

55%

45%

Plasma
100%

H_2O
91.5%

Proteins
7.5%

Solutes/
waste
1%

electrolytes, vitamins, gases, hormones

RBCs
99%

Formed Elements
100%

Platelets
WBCs 1%

WBC concentration

Neutrophil
65%

Lymphocyte
23%

Monocyte
5%

Eosinophil
4%

Basophil
1%

Plasma Protein composition		
Albumins 54% smallest, most abundant. transport fatty acids	**Globulins 38%** from plasma & liver cells; 38% Gamma Globulins Immunoglobulins	Fibrinogen **7%** + trace substances

fibriniogen- 7%, made by liver

Define the following?

- **Oxyhemoglobin** –
- **Deoxyhemoglobin**
- **Carbaminohemoglobin**

Define the following?

- **Oxyhemoglobin** – Hb bound to oxygen
  - Oxygen loading takes place in the lungs
- **Deoxyhemoglobin** – Hb after oxygen diffuses into tissues (reduced Hb)
- **Carbaminohemoglobin** – Hb bound to carbon dioxide

What are the normal adult Hemoglobin?

What are the normal adult Hemoglobin?

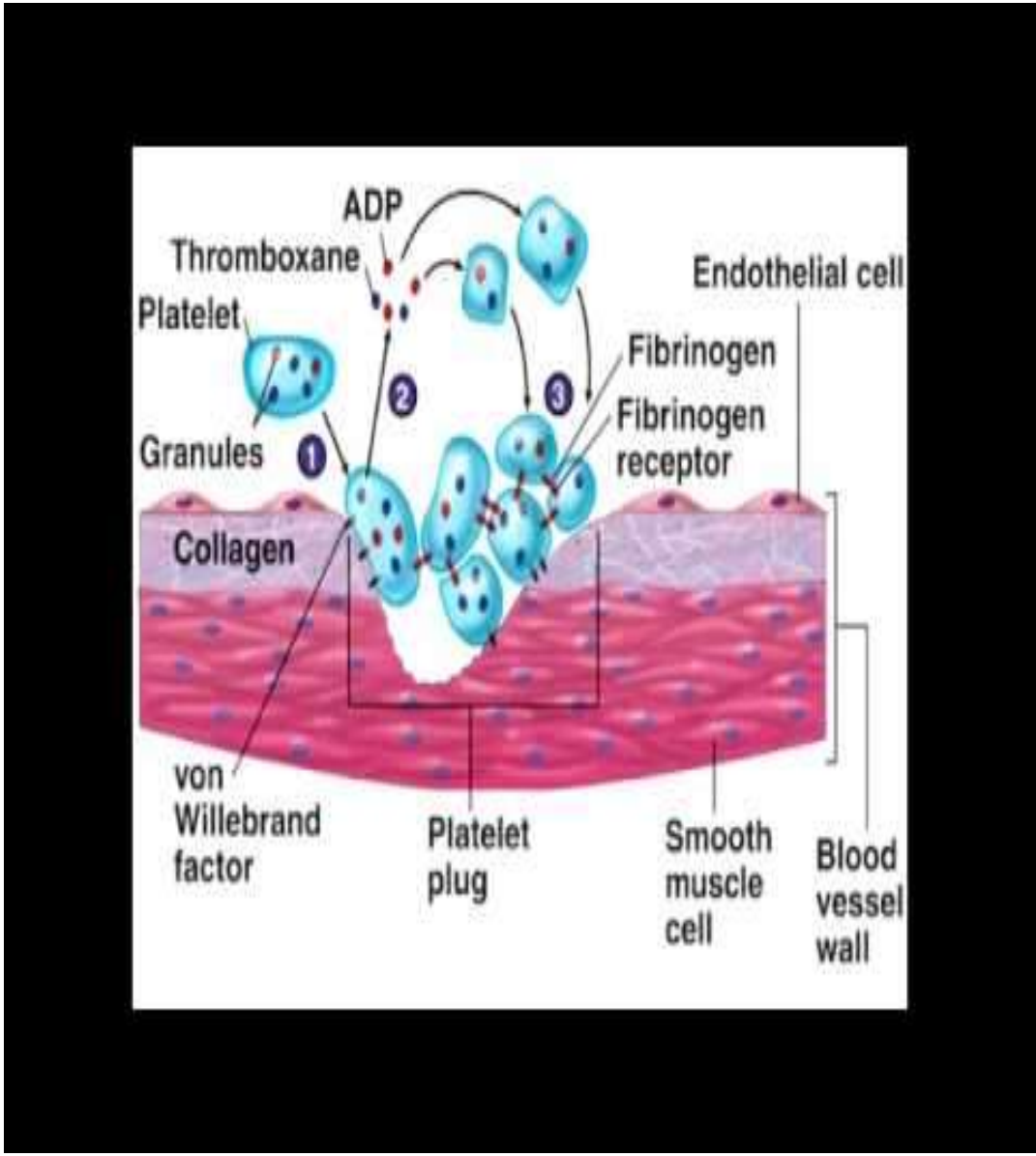
- **Hemoglobin A_2** $\alpha_2\delta_2$ **Minor adult hemoglobin**
- **Hemoglobin A** $\alpha_2\beta_2$ **Major adult hemoglobin**

Define platelet plug?

Define platelet plug?

- The platelet plug, also known as the hemostatic plug or platelet thrombus, is an **aggregation of platelets formed during early stages of hemostasis in response to one or more injuries to blood vessel walls**.

- The result of the platelet plug formation is the coagulation of blood.



- A neighbor come to show you his lab.
- Neutrophils 140
- Lymphocytes 40
- Monocytes 4
- Eosinophils 4
- Basophils 1

- How do you calculate the differential white count in percentage?

$$\text{Differential white count} = \frac{\#\text{ of cell (100)}}{\text{Total of wbc}}$$

$$\text{Neutrophils} = \frac{140}{189}(100) = 74\%$$

Define hematocrit?

Hematocrit (HCT) is the calculated volume percentage of red blood cells (erythrocytes) in your blood.

Hematocrit is also called packed cell volume (PCV) or erythrocyte volume fraction.

The word hematocrit means to separate blood. In a hematocrit test, the red blood cells are separated from the rest of your blood cells and plasma.

Human blood contains red blood cells, white blood cells, and platelets suspended in a liquid called plasma.

Normal value for hematocrit in an adult male?

The average hematocrit measurement for human beings is 45%, which means that the red cell volume contains **45 mL per 100 mL of blood**

- **Male: 41% to 50%**
- **Female: 36% to 44%**
- **Newborn: 45% to 61%**
- **Infant: 32% to 42%**

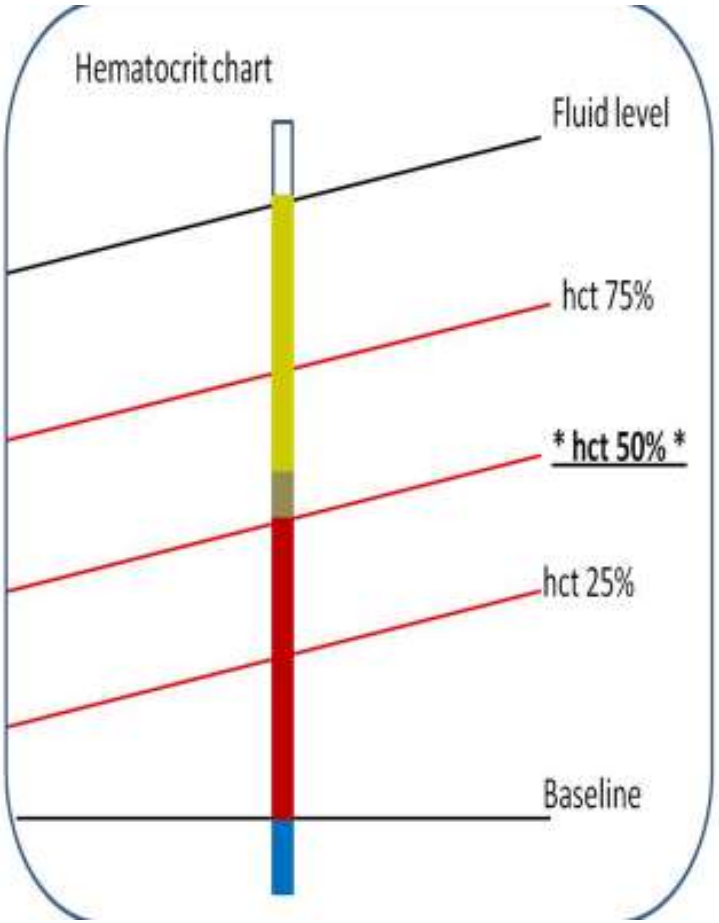
What does it mean if your hematocrit is high?

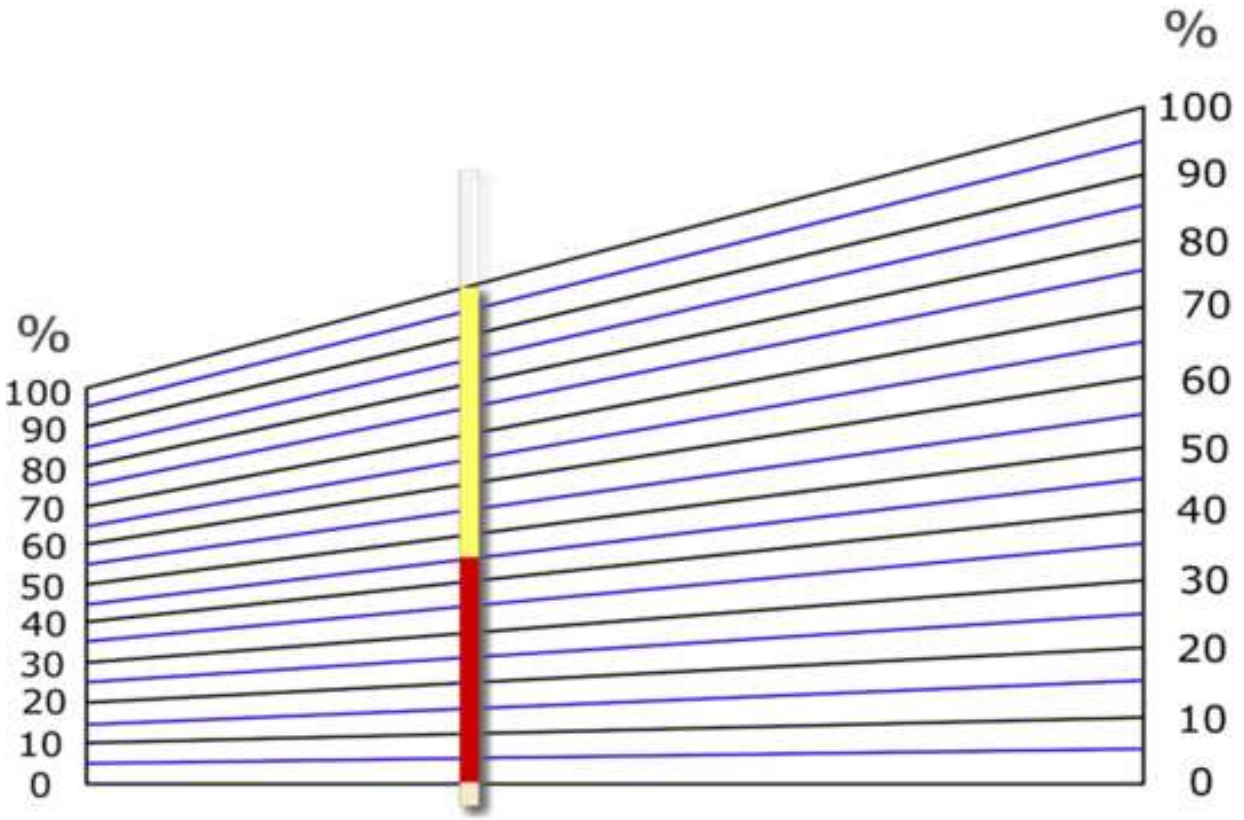
If your hematocrit is high, it means that **you have more red blood cells than is considered healthy**.
High hematocrit may be caused by :
•Heart disease
•**Dehydration**
•**Polycythemia (too many red cell)**
•Scarring or thickening of the lungs
•Bone marrow disease
•Obstructive sleep apnea
•Smoking and chronic obstructive pulmonary disease (COPD)
•Carbon monoxide poisoning
•Testosterone use

What does it mean if your hematocrit is low?

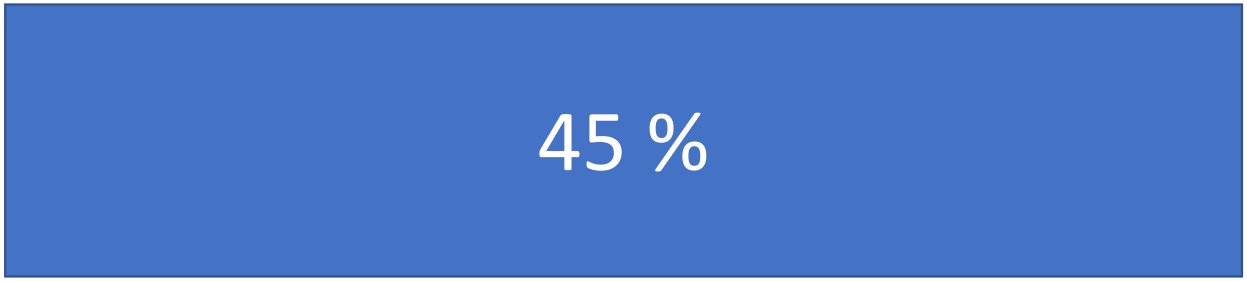
you have fewer red blood cells than is considered healthy.

- Blood loss
- Anemia
- Leukemia or other bone marrow problems
- Iron and vitamin deficiency, including folate, vitamin B12, and vitamin B6 = anemia
- Too much water in the body
- Kidney disease
- Thyroid abnormality
- Immune destruction of red blood cells



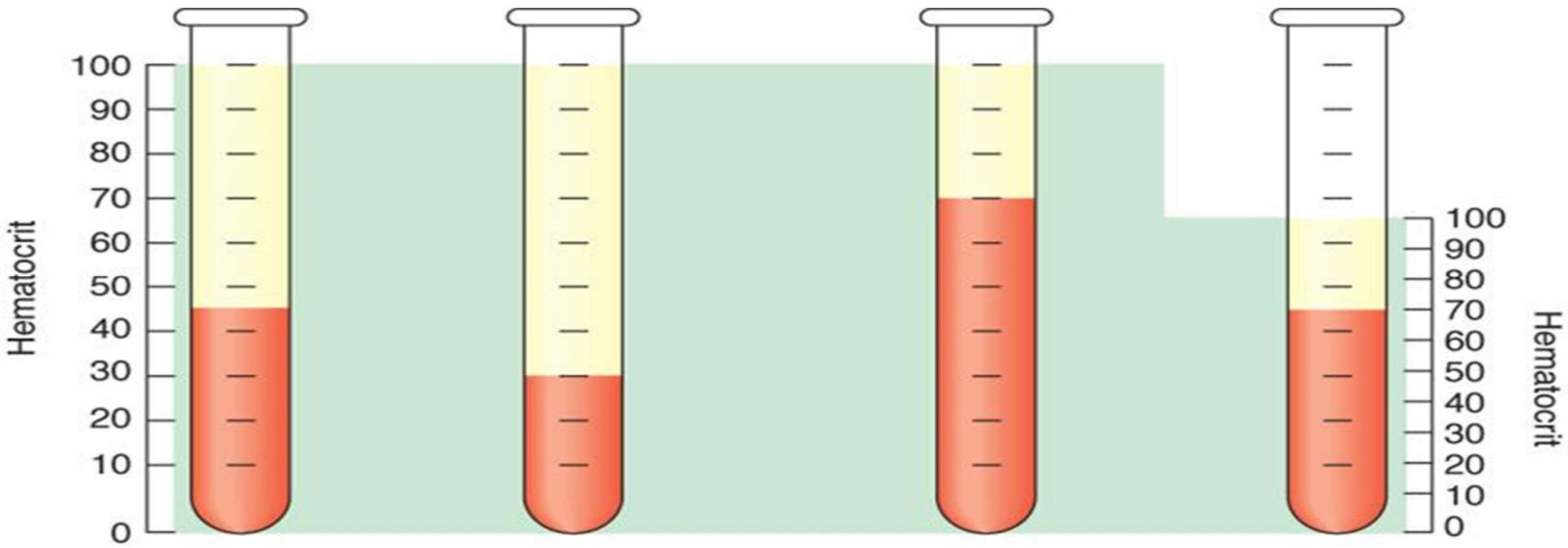


What is the hematocrit level?

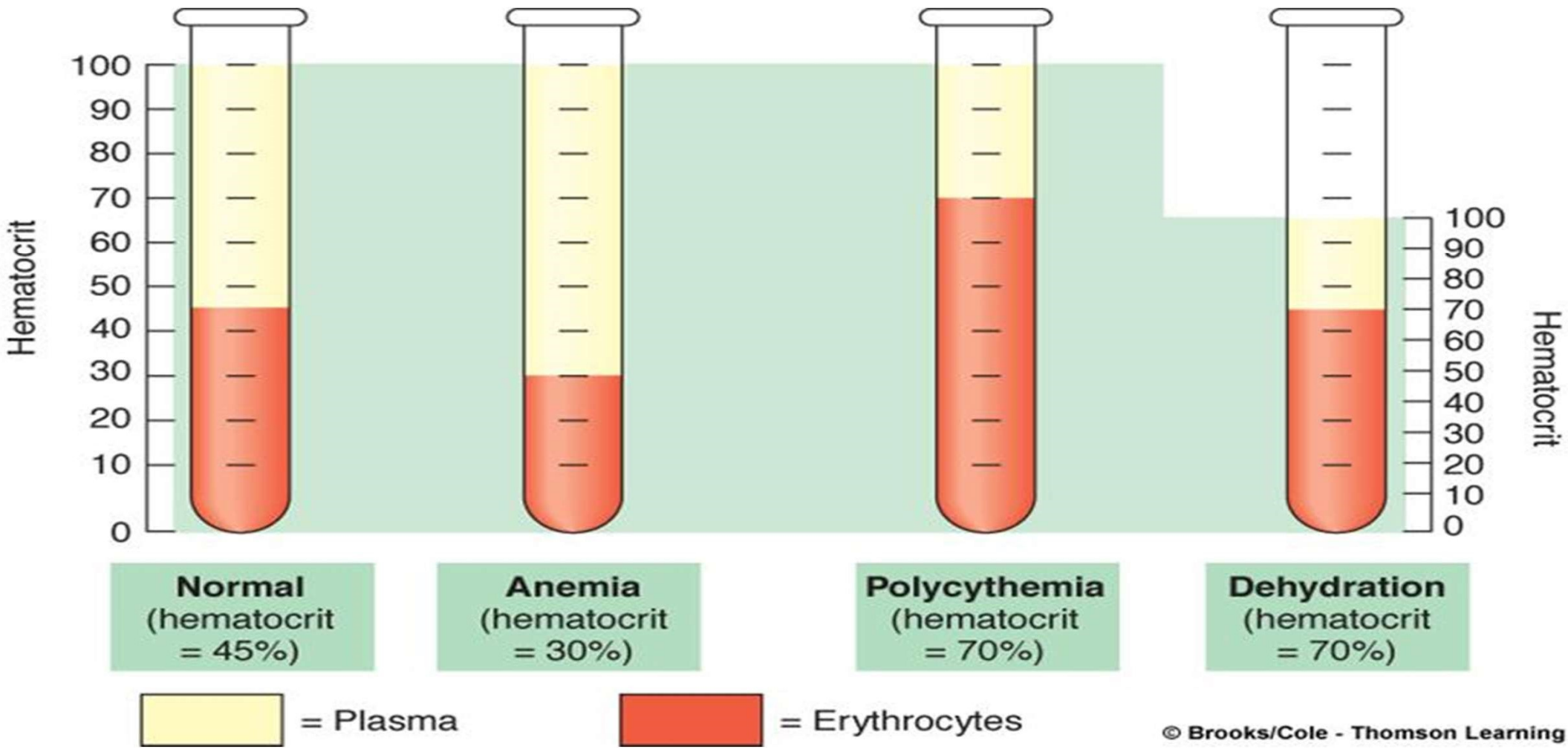

45 %

HEMATOCRIT= formula

$$\text{HEMATOCRIT} = \frac{\text{PACKED RBC HEIGHT}}{\text{TOTAL SAMPLE HEIGHT}} \times 100$$



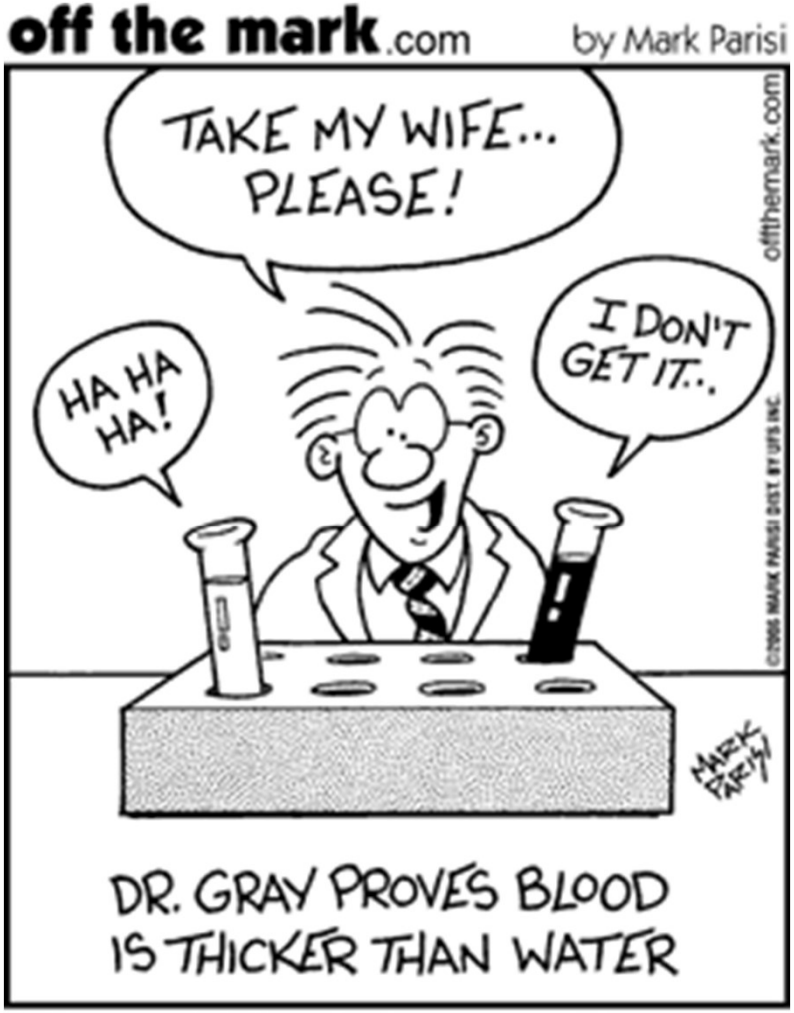
What do you think of these different 4 tubes?



What kind of tissue is blood?

What serves as the matrix of blood?

How much blood is in the human body?



What kind of tissue is blood?

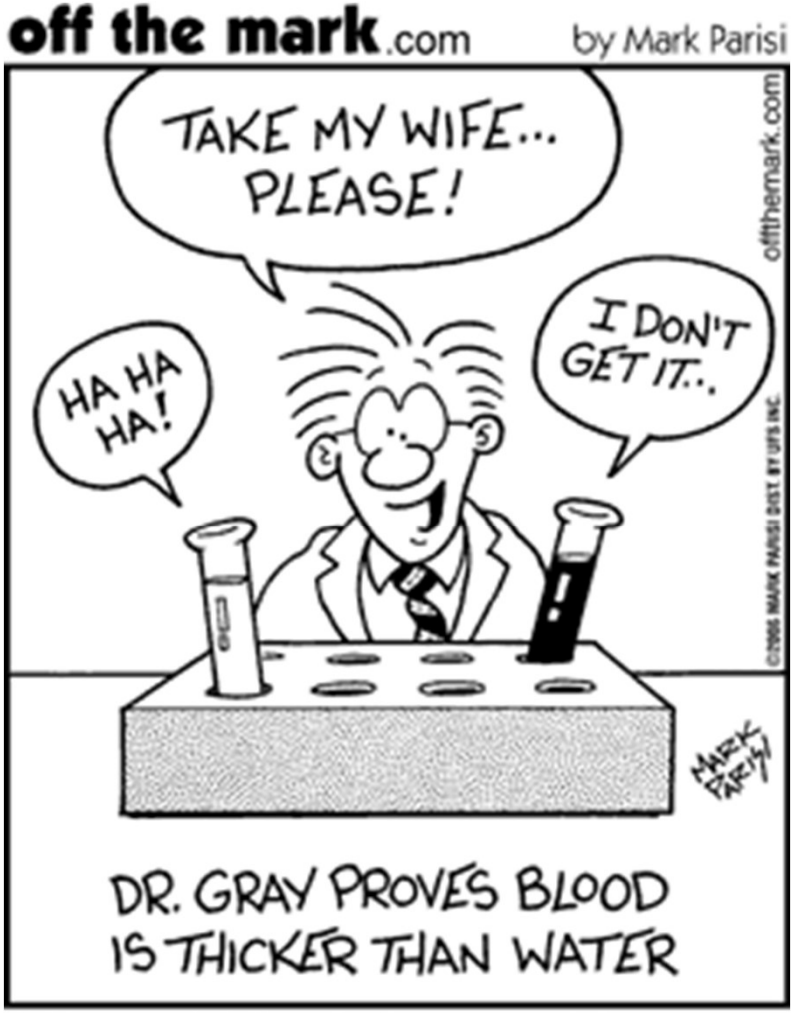
- Connective tissue

What serves as the matrix of blood?

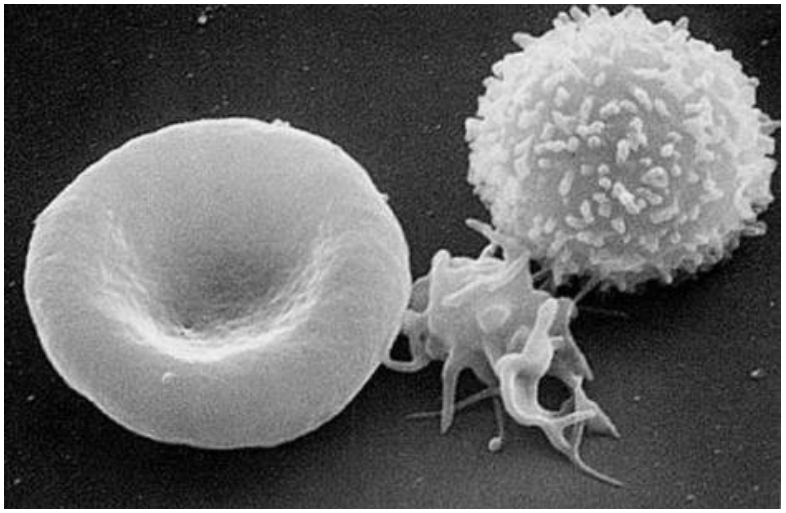
- Plasma

How much blood is in the human body?

- 4-5 liters

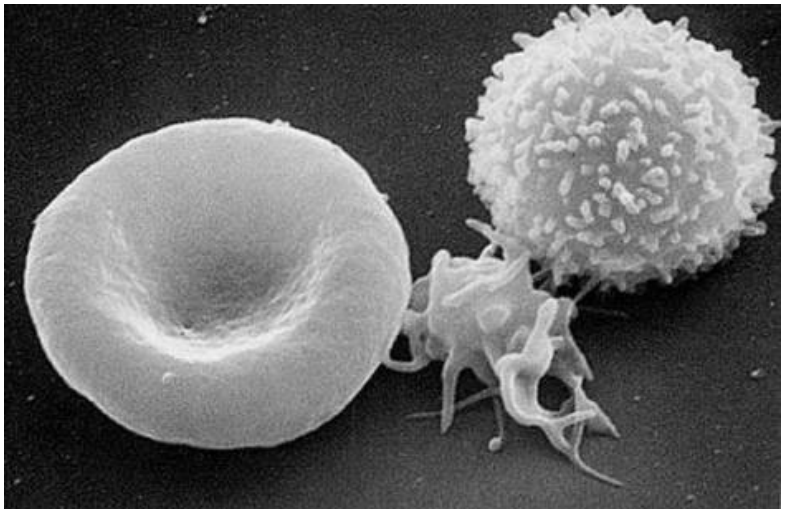


What comprises blood?



What comprises blood?

- Plasma
- Formed elements
  - Erythrocytes
  - Thrombocytes
  - Leukocytes
    - Neutrophils
    - Lymphocytes
    - Monocytes
    - Eosinophils
    - Basophils



*"**N**ever **L**et **M**onkeys **E**at **B**ananas!"*

Where does each cell creation function occur:

• Thrombopoiesis	Red marrow (adult)
• Erythropoiesis	Red marrow/lymphoid tissue
• Leukopoiesis	Liver and kidneys

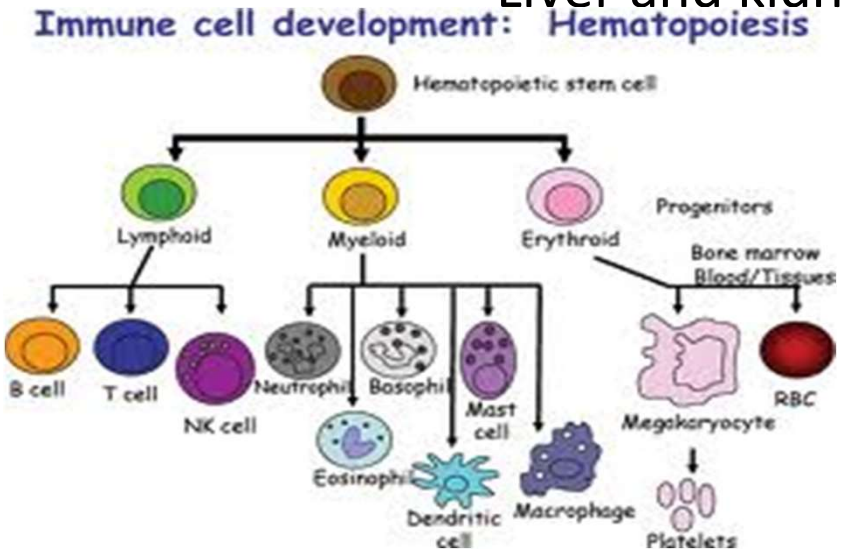
Where does each cell creation function occur:

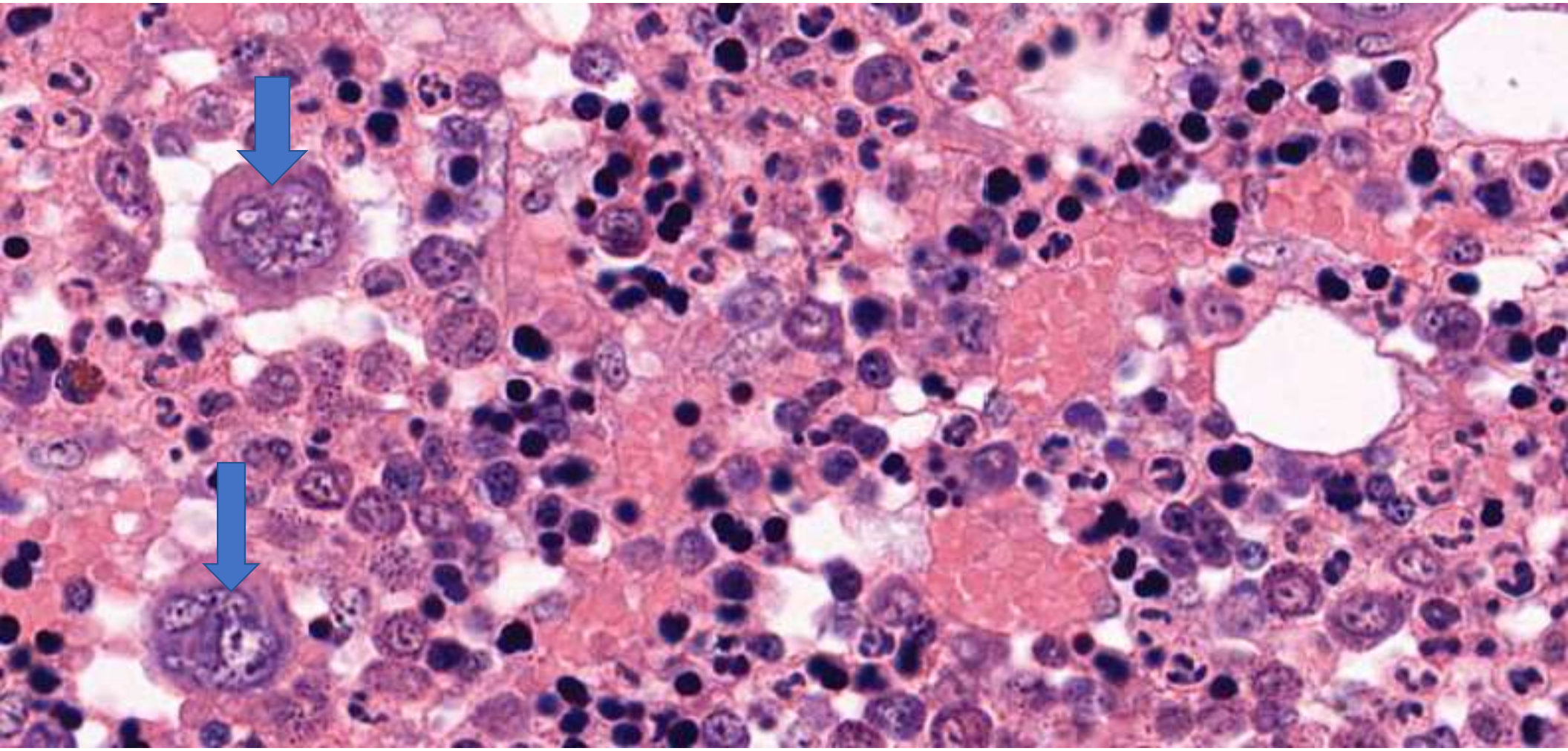
- Thrombopoiesis
- Erythropoiesis
- Leukopoiesis

Red marrow (adult)

Red marrow/lymphoid tissue

Liver and kidneys



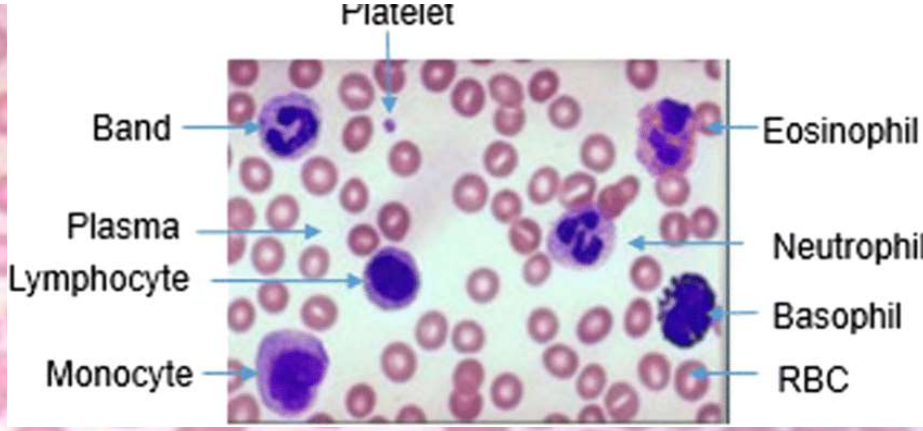


THIS IS THE BONE MARROW COULD YOU IDENTIFY THE BLUE ARROw CELLS?

MEGAKAYOCYTES


What cells do you recognize?

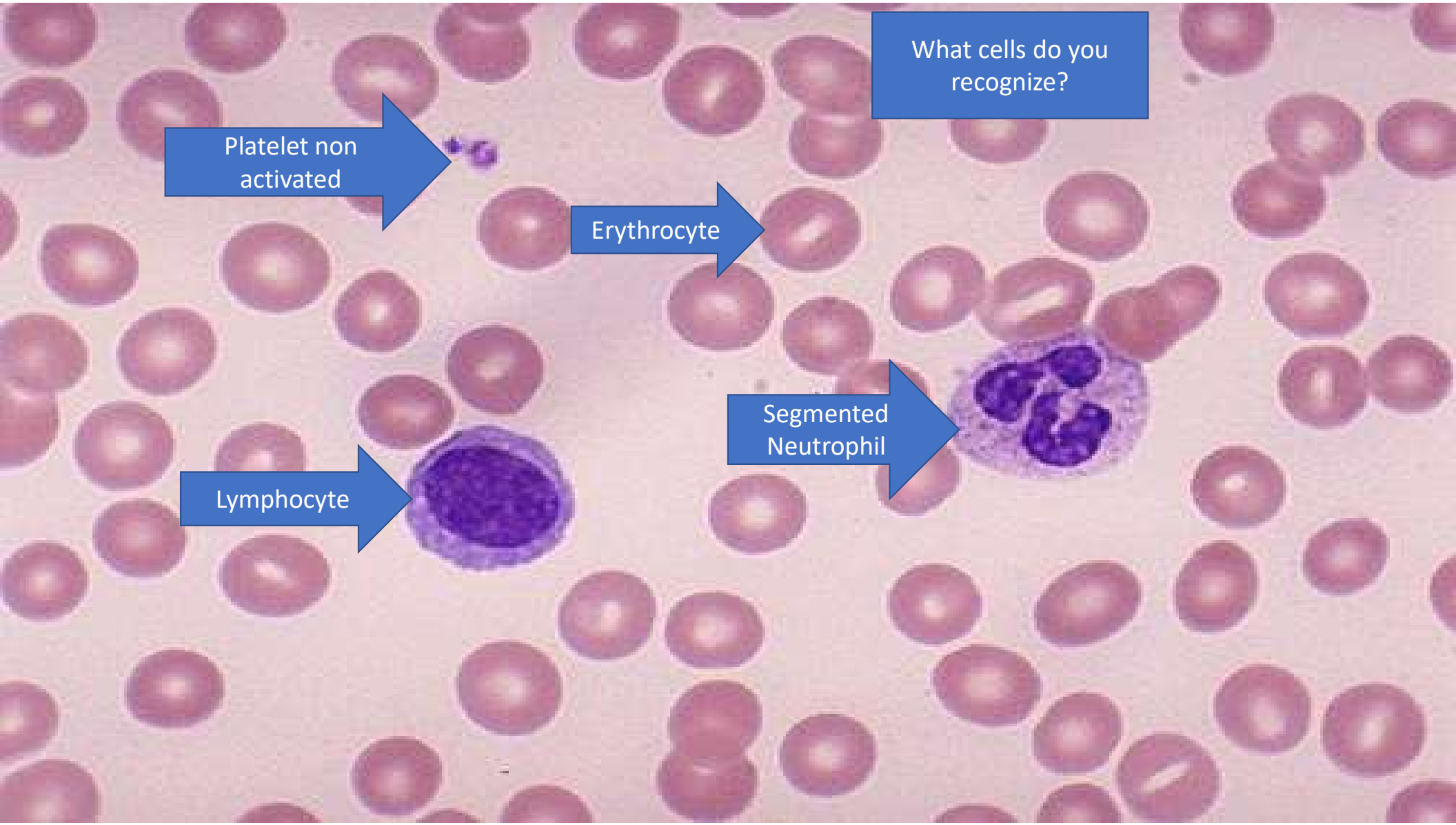
What cells do you recognize?

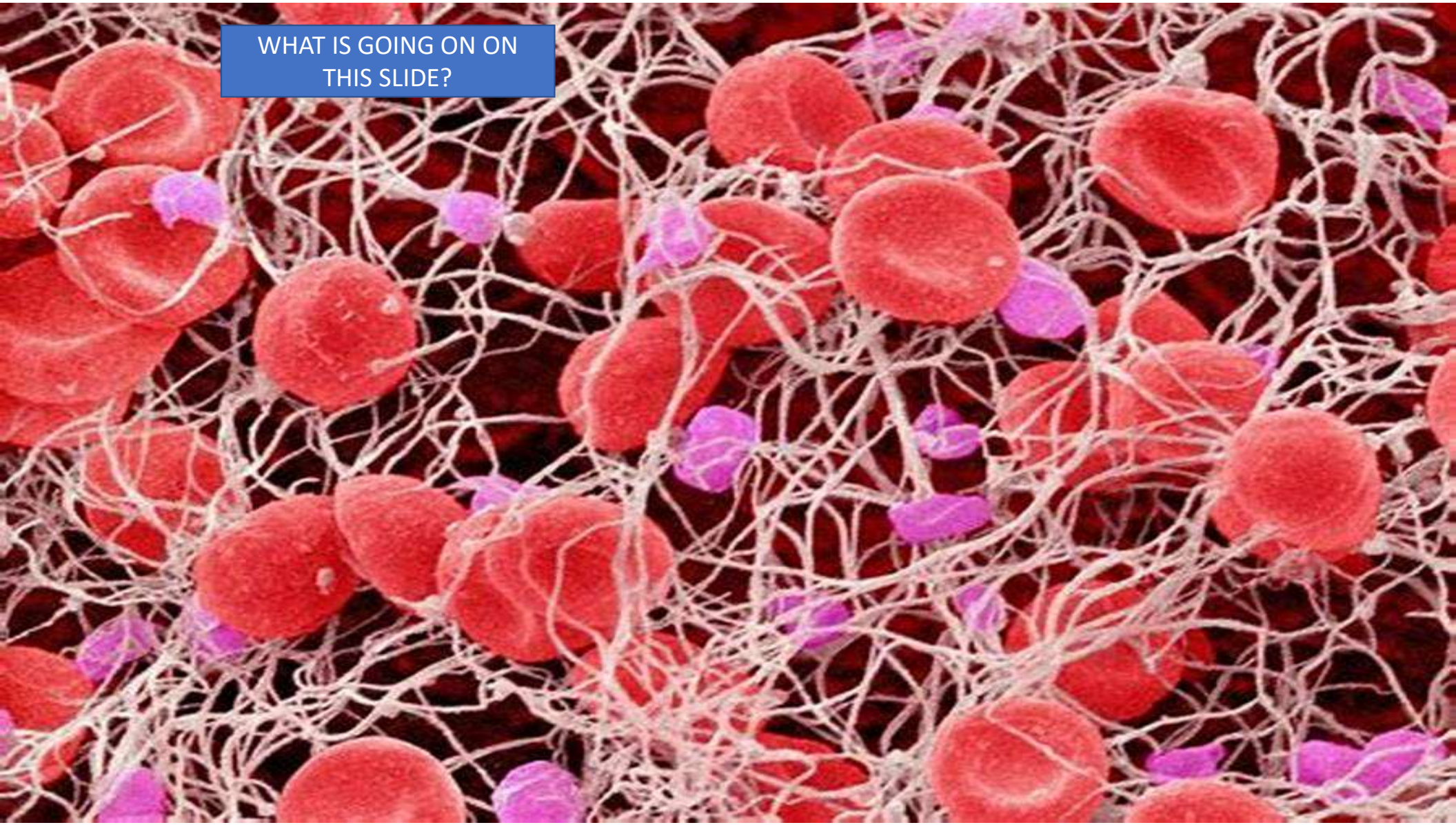


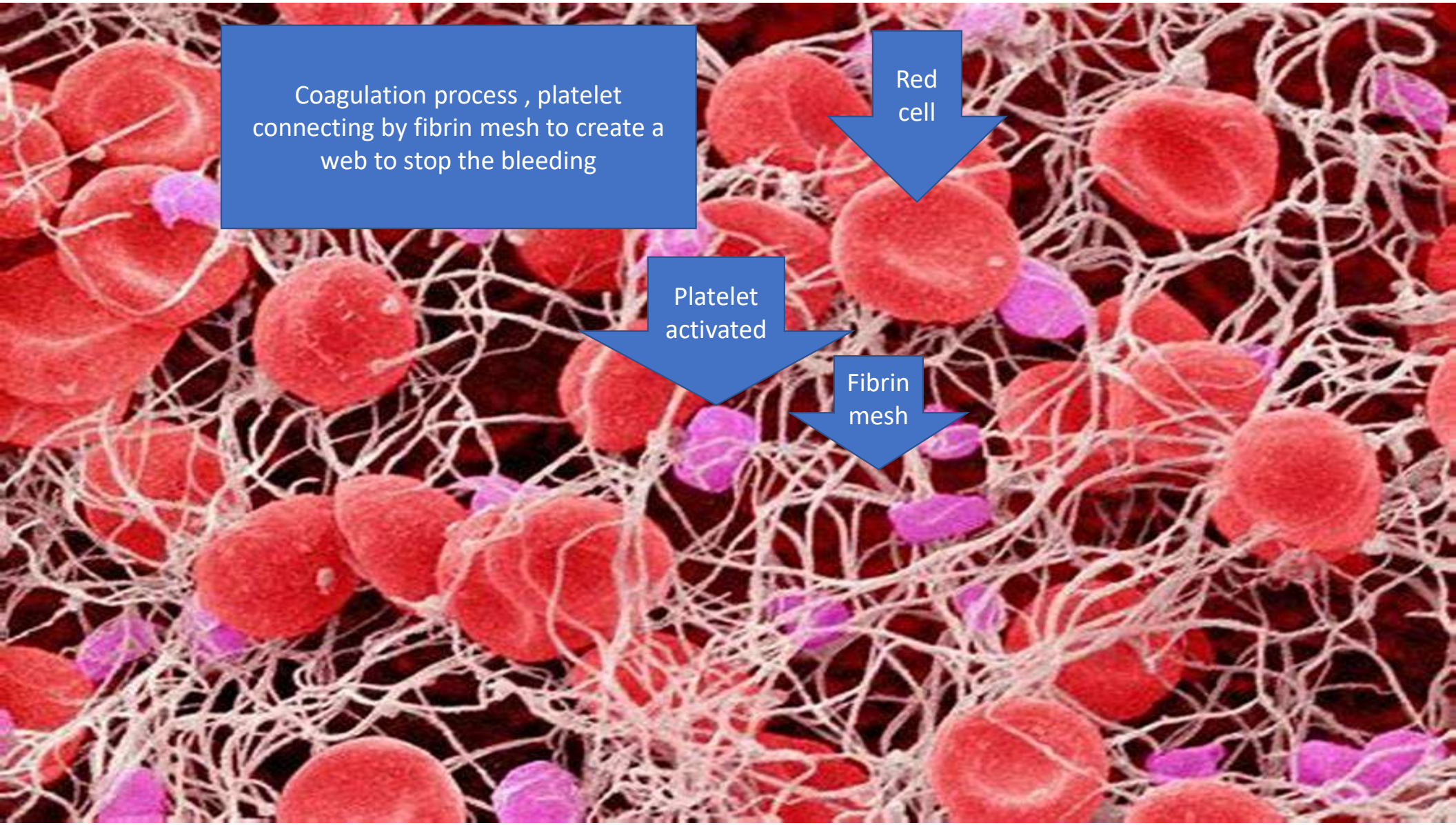
Erythrocyte

Neutrophil


What cells do you recognize?


What cells do you recognize?
Platelet non activated
Erythrocyte
Segmented Neutrophil
Lymphocyte


WHAT IS GOING ON ON
THIS SLIDE?

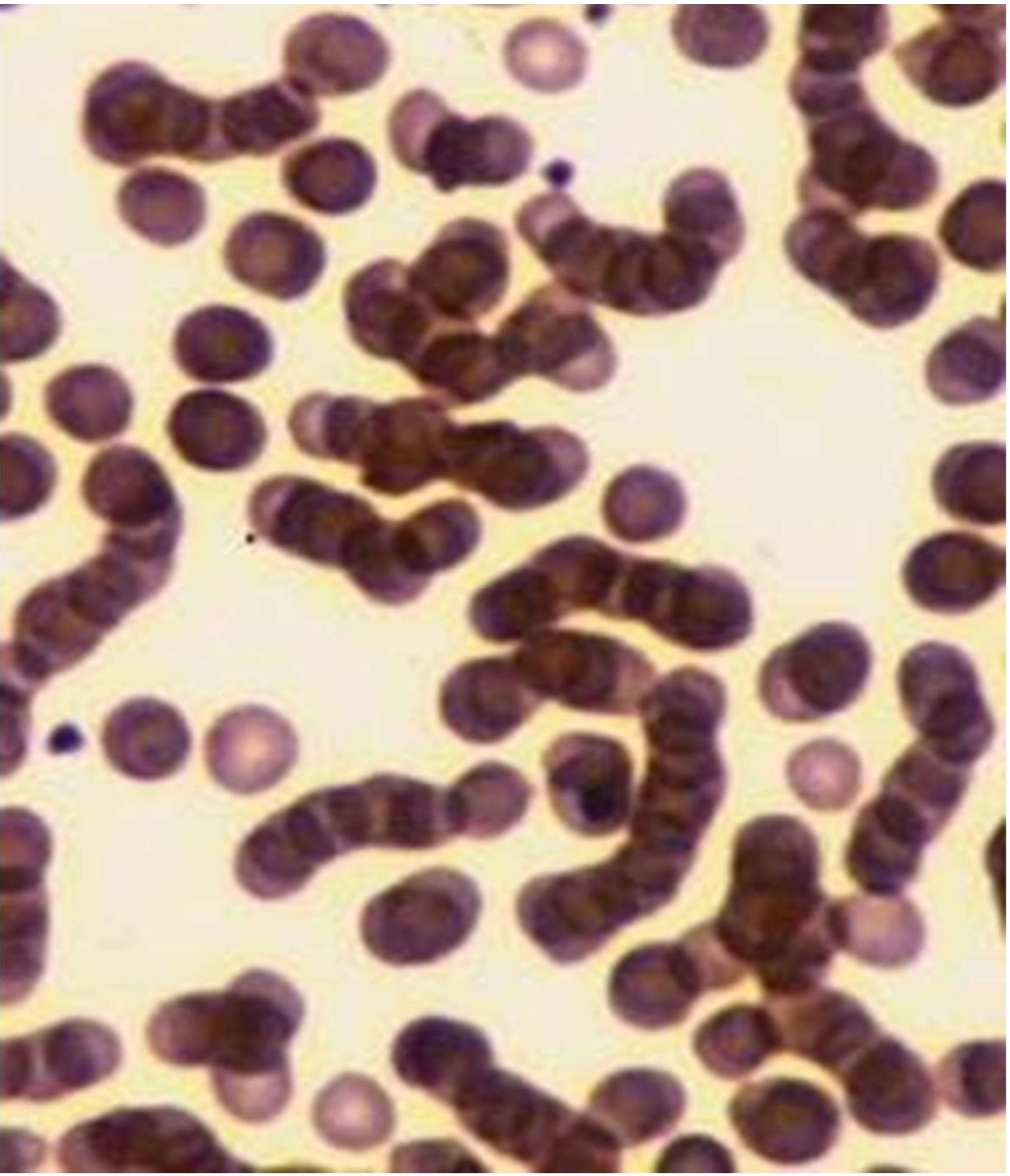

Coagulation process , platelet connecting by fibrin mesh to create a web to stop the bleeding
Red cell
Platelet activated
Fibrin mesh

ABO BLOOD GROUPS

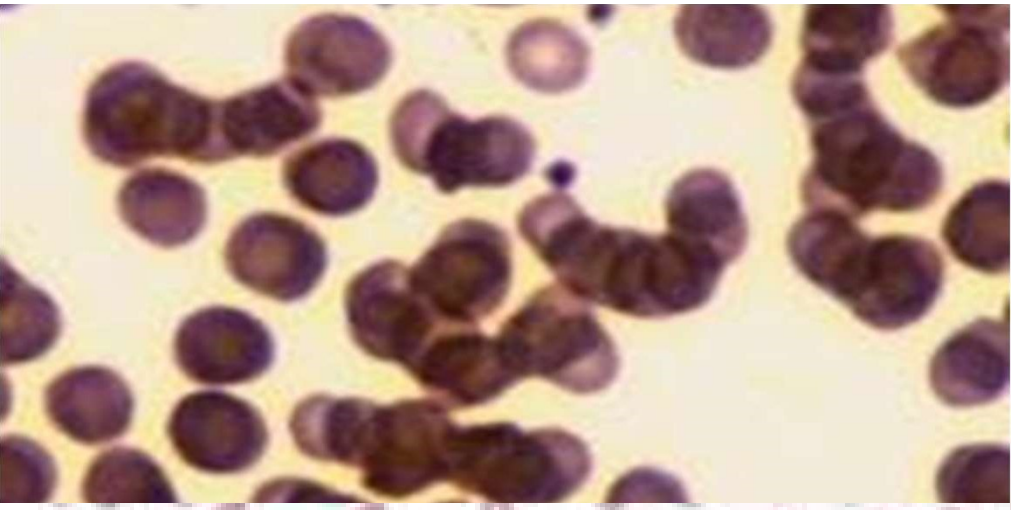
Blood Group	Antigens on RBCs	Antibodies in Serum	Genotypes
A	?	?	?
B	?	?	?
AB	?	?	?
O	?	?	?

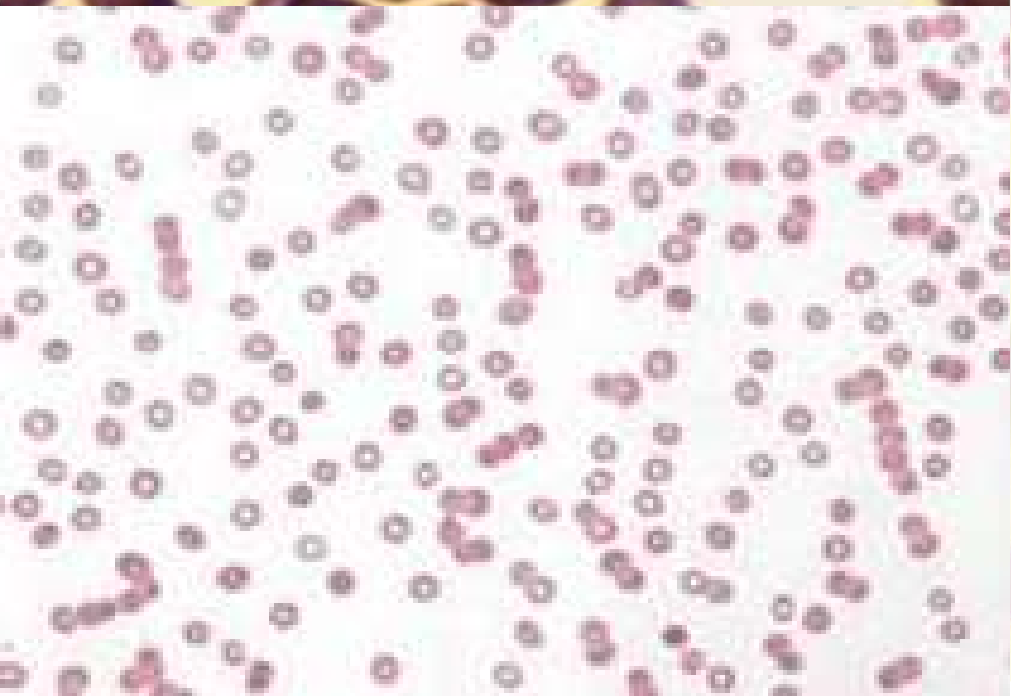
ABO BLOOD GROUPS

Blood Group	Antigens on RBCs	Antibodies in Serum	Genotypes
A	**A**	Anti-B	*AA* or *AO*
B	**B**	Anti-A	*BB* or *BO*
AB	**A** and **B**	Neither	*AB*
O	Neither	Anti-A and Anti-B	*OO*



What is going on on this slide?





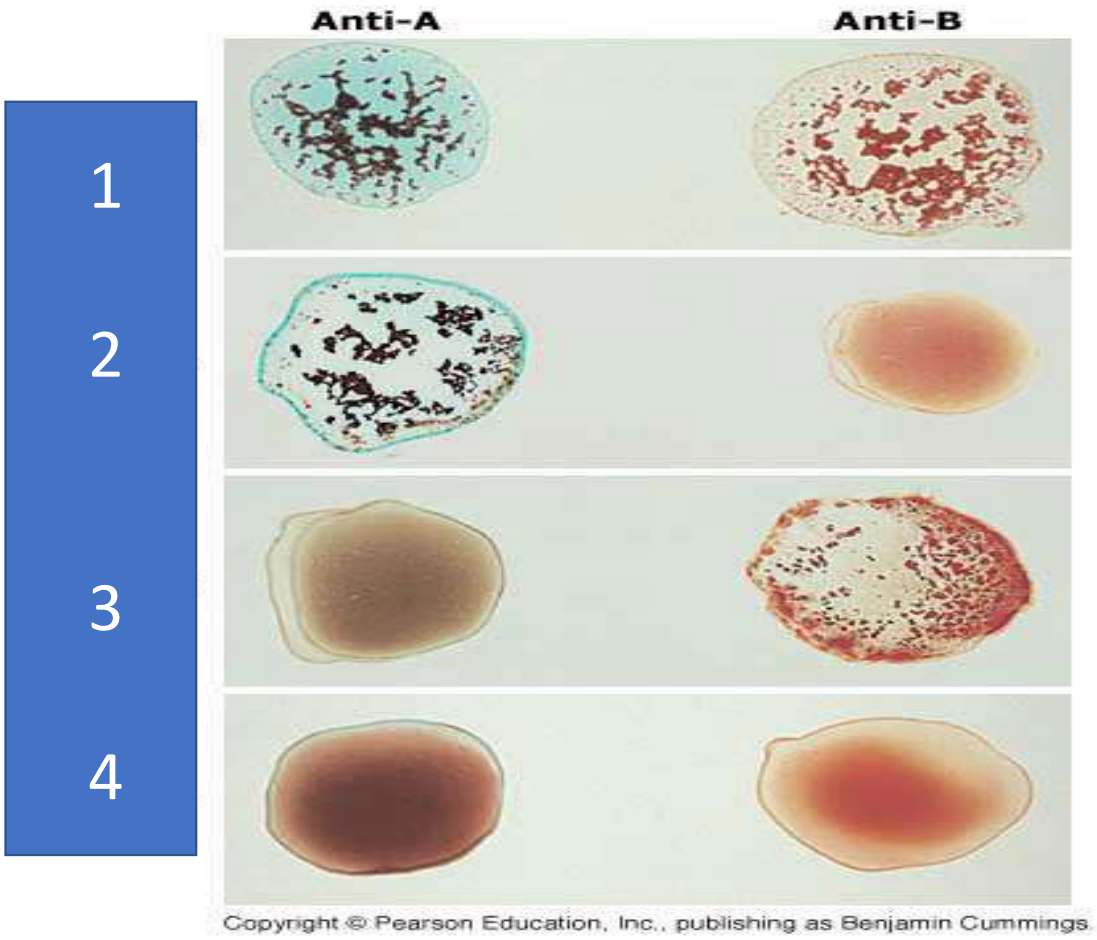
What is going on on this slide?

The stacking of cells (rouleaux formation)

facilitates the rate of red cell sedimentation, a phenomenon that may be seen on a peripheral smear.

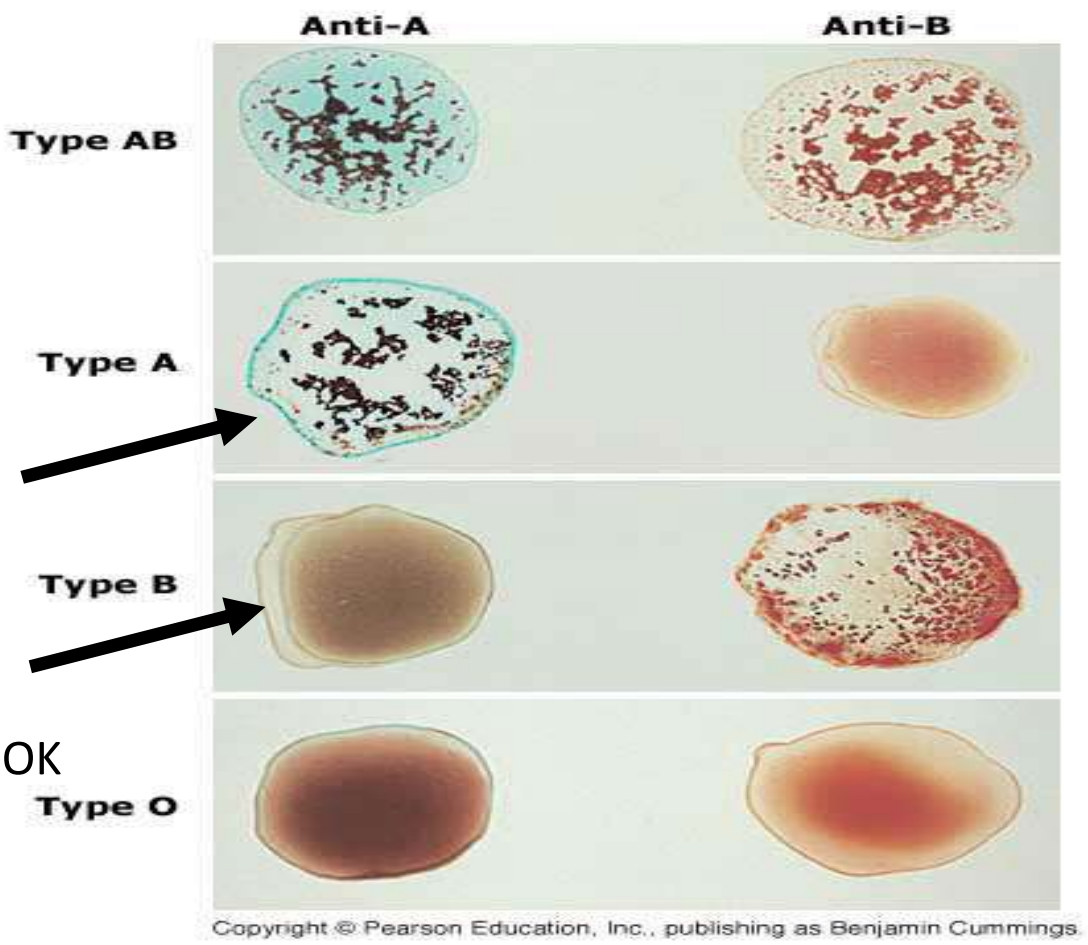
The appearance of rouleaux may be artificially caused by a poor preparation of the smear or by viewing the slide in a thickened area

What causes rouleaux formation?
Conditions that cause rouleaux formation include infections, multiple myeloma, Waldenström's macroglobulinemia, inflammatory and connective tissue disorders, and cancers. It also occurs in diabetes mellitus and is one of the causative factors for microvascular occlusion in diabetic retinopathy



Multiple alleles

ABO blood group s

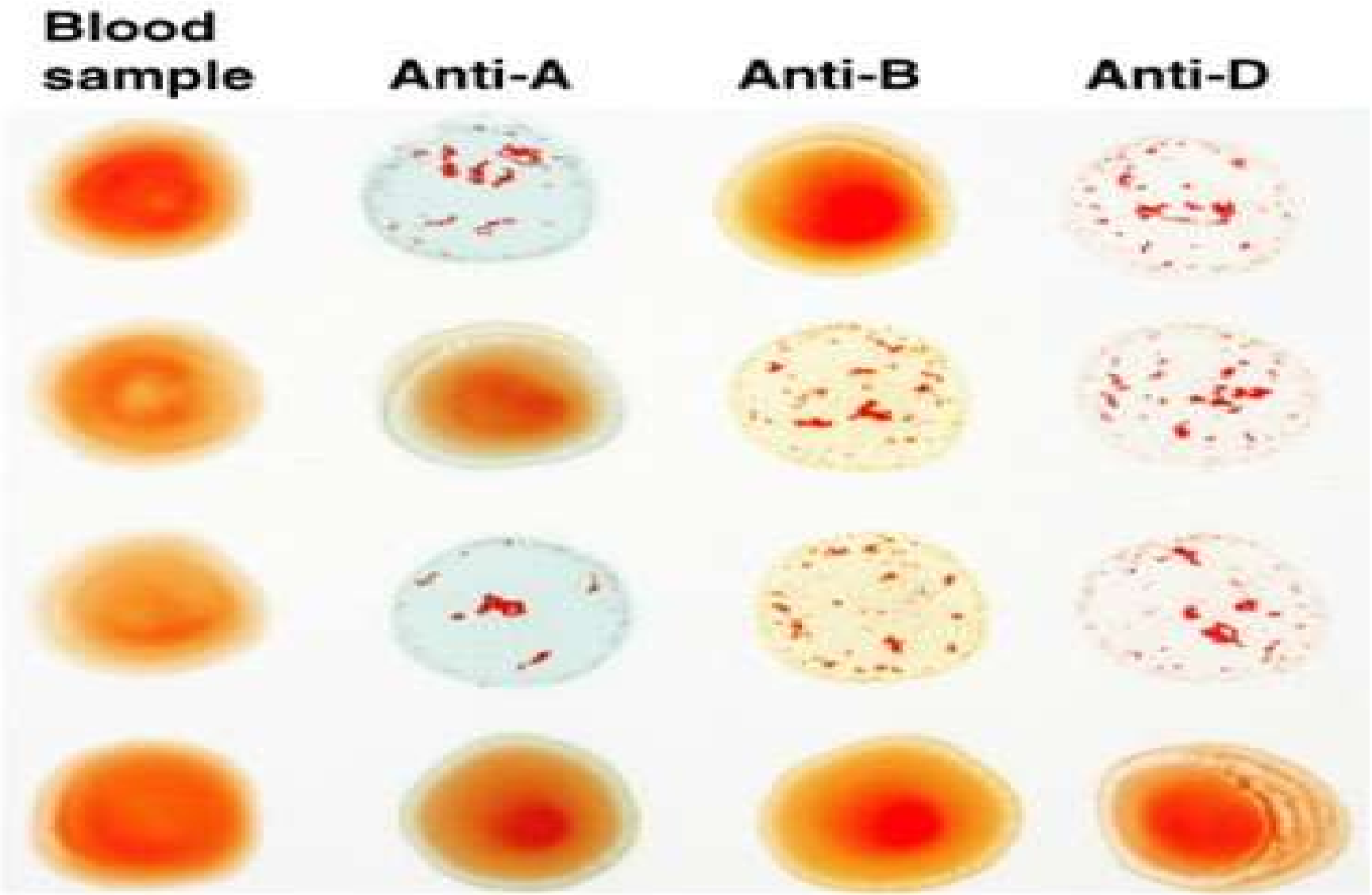


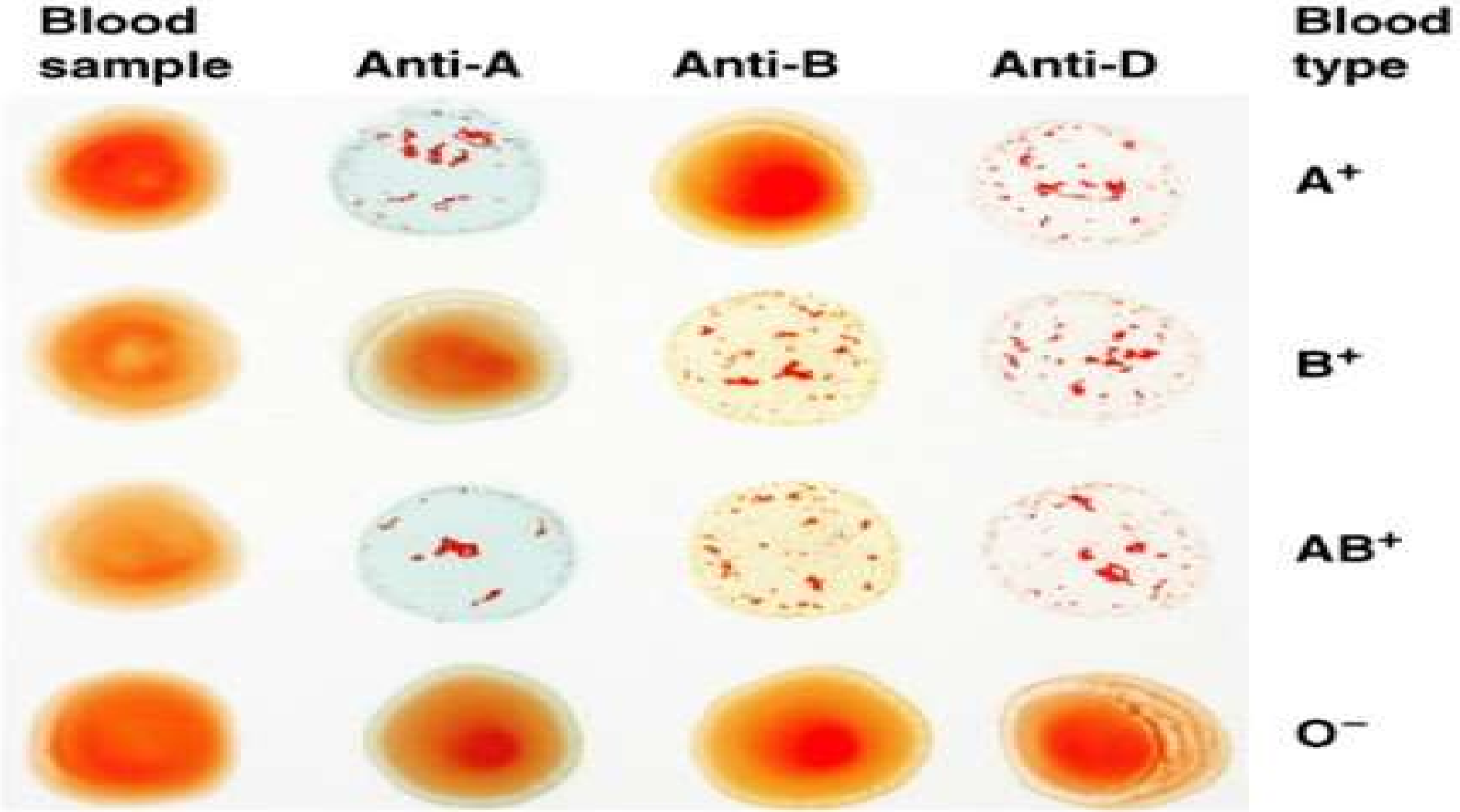
Type A blood transfused into Type B person

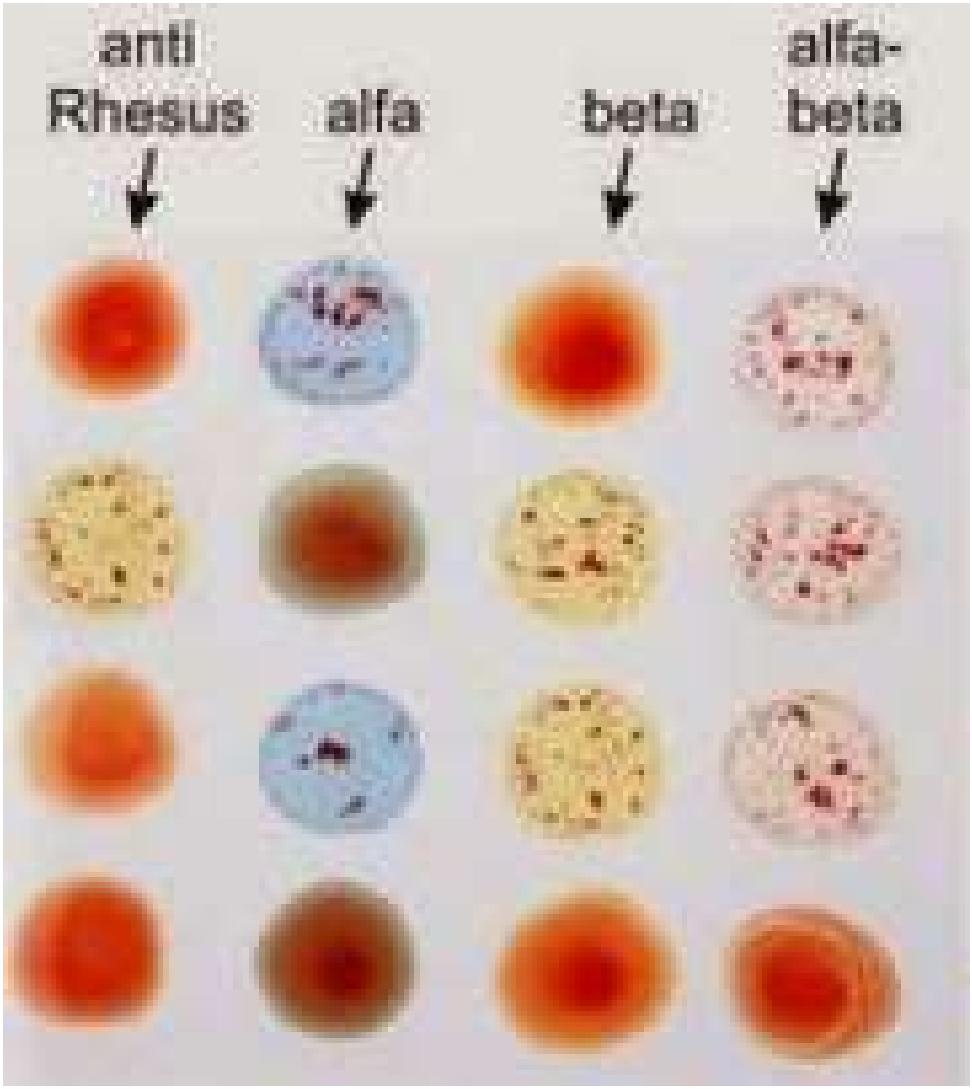
Type B blood transfused into Type B person - OK

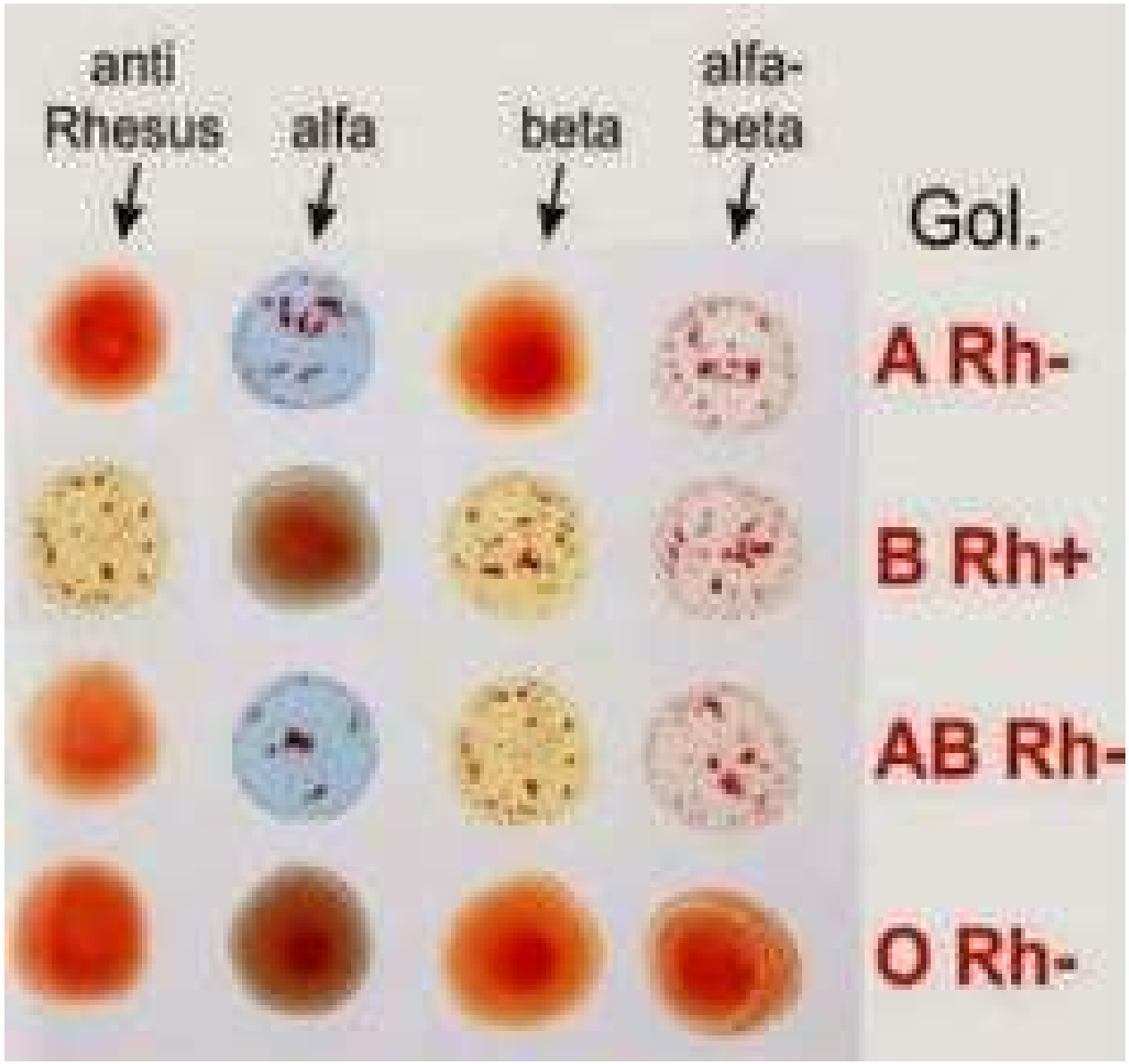
A medical problem - some blood transfusions produce lethal clumping of cells.

Don't worry about details yet...


Blood sample
Anti-A
Anti-B
Anti-D


Blood sample
Anti-A
Anti-B
Anti-D
Blood type
A+
B+
AB+
O−


anti
Rhesus
alfa
beta
alfa-
beta


anti
Rhesus
alfa
beta
alfa-
beta
Gol.
A Rh-
B Rh+
AB Rh-
O Rh-

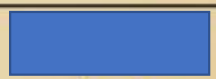
Blood Type	Cell Antigen	Serum Antibodies	Donor
A		B	
B			
AB		None	
O	None		

Table 1. ABO Blood Groups

Blood Type	Cell Antigen	Serum Antibodies	Donor
A	A	B	A or O
B	B	A	B or O
AB	AB	None	All
O	None	A and B	O

Table 1. ABO Blood Groups

Mother's Blood Type	Father's Blood Type: A	Father's Blood Type: B	Father's Blood Type: AB	Father's Blood Type: O
A	1	A, B, AB, or O	2	A or O
B	A, B, AB, or O	3	A, B, or AB	B or O
AB	4	A, B, or AB	A, B, or AB	5
O	A or O	6	A or B	7

Child's Blood Type

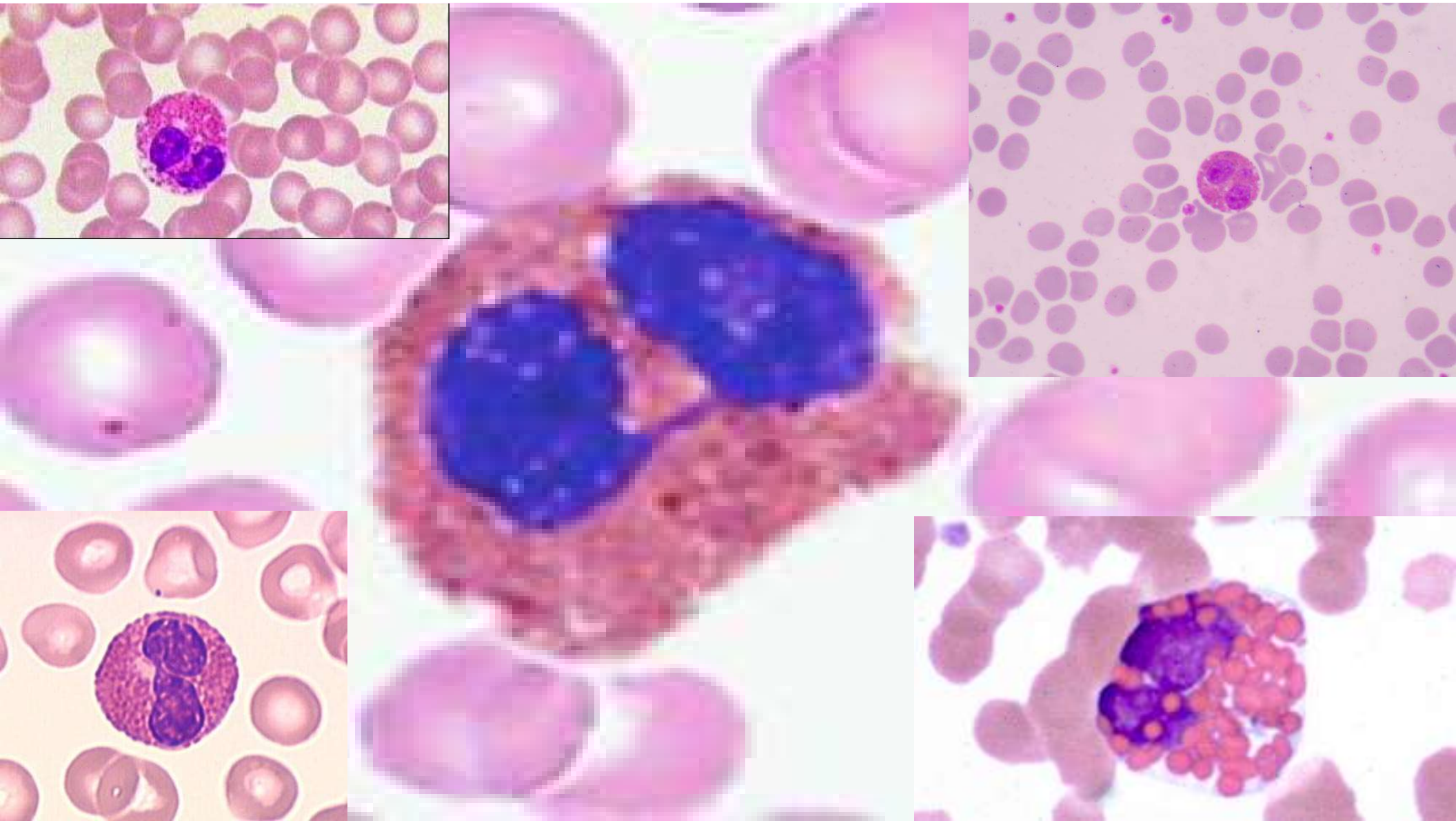
Mother's Blood Type	Father's Blood Type: A	Father's Blood Type: B	Father's Blood Type: AB	Father's Blood Type: O
A	A or O	A, B, AB, or O	A, B, or AB	A or O
B	A, B, AB, or O	B or O	A, B, or AB	B or O
AB	A, B, or AB	A, B, or AB	A, B, or AB	A or B
O	A or O	B or O	A or B	O

Child's Blood Type

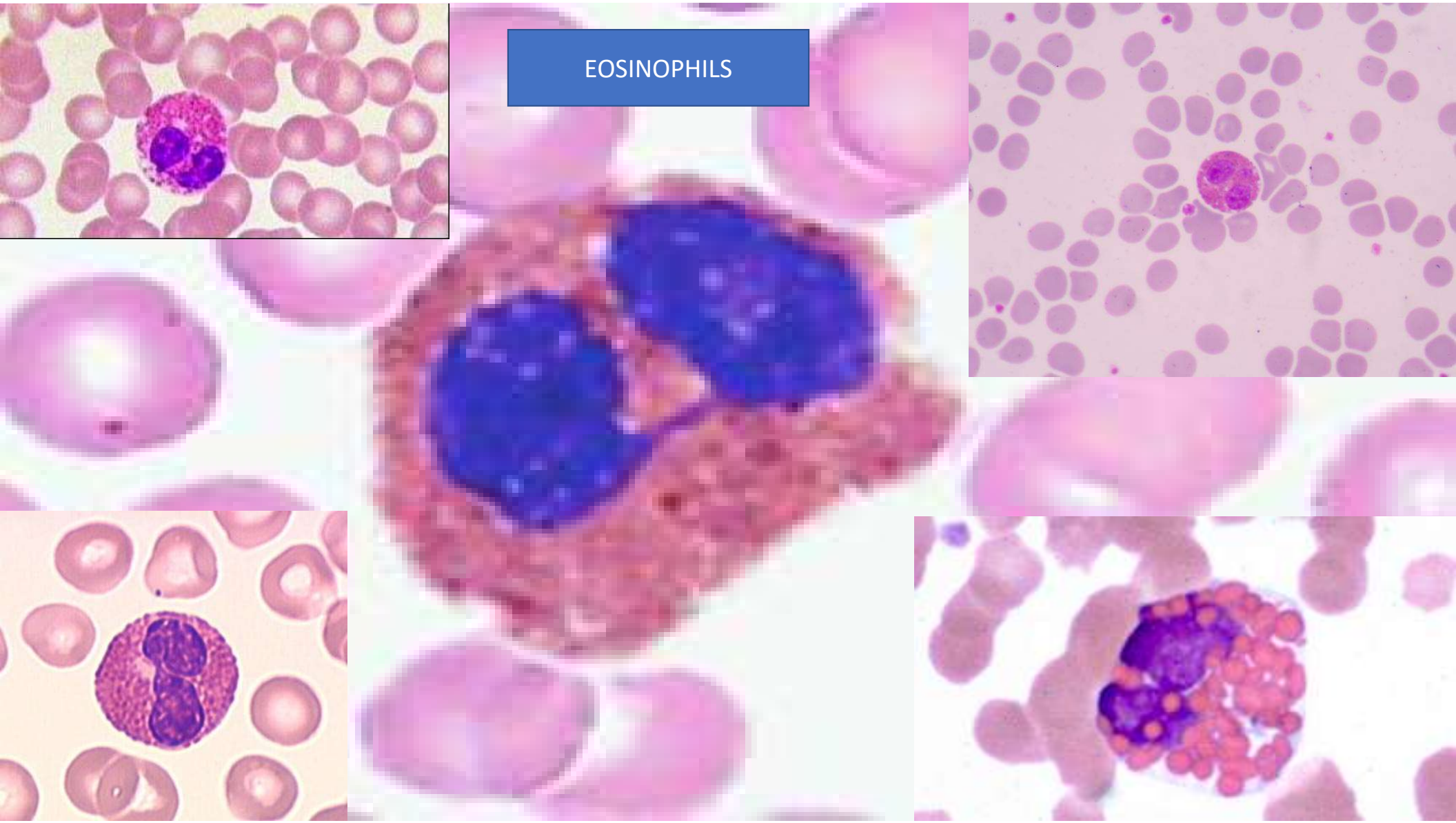
1/DETERMINE THE GROUP AND RHESUS OF THIS INDIVIDUAL?

1/DETERMINE THE GROUP AND RHESUS OF THIS INDIVIDUAL?

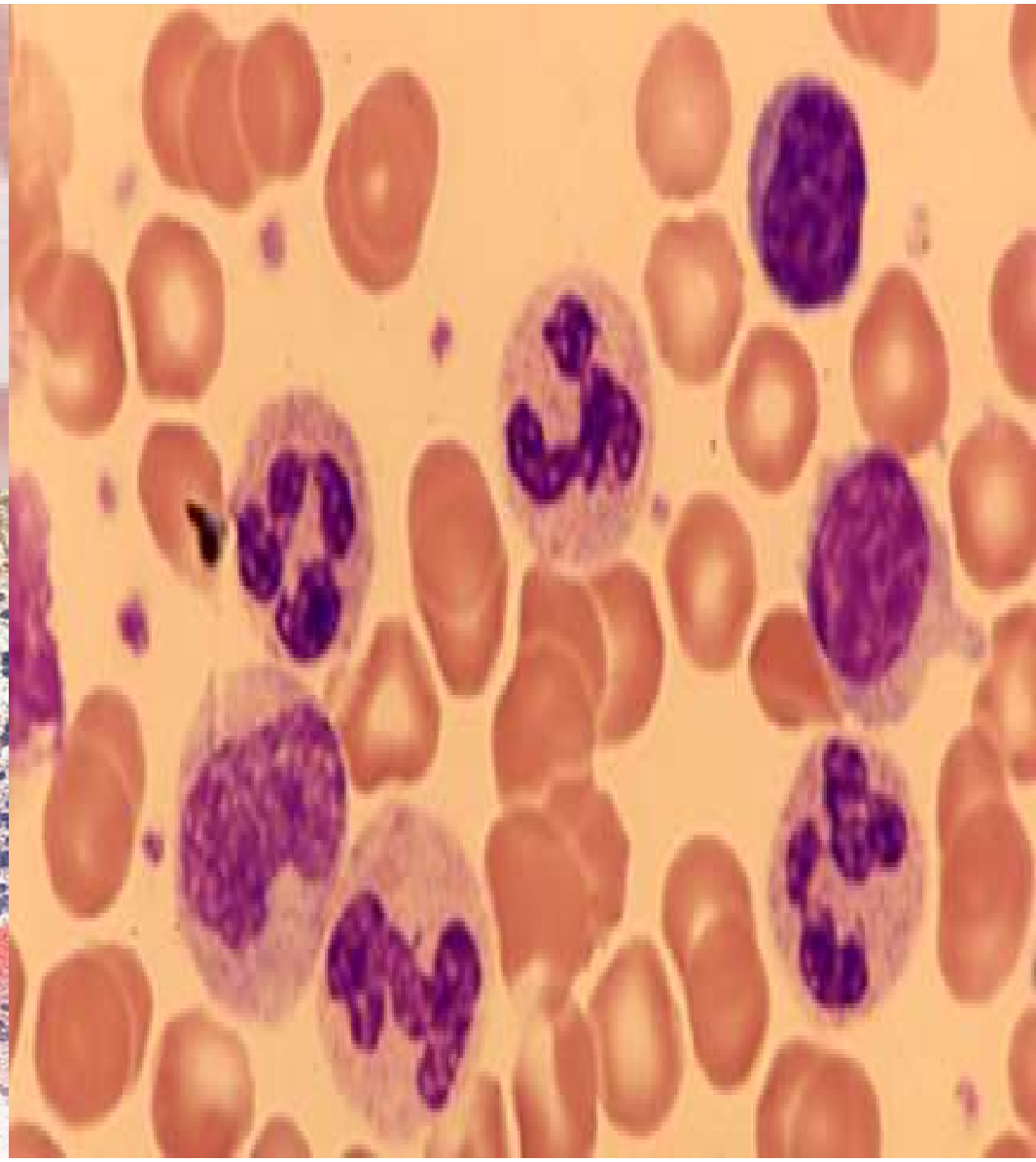
A+

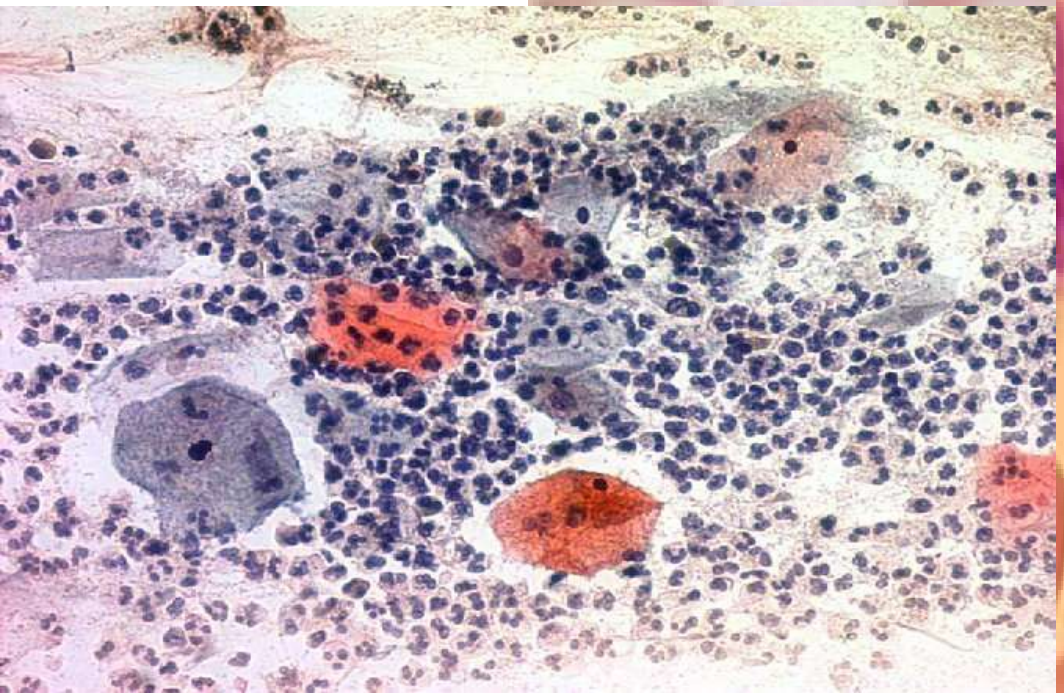


EOSINOPHILS

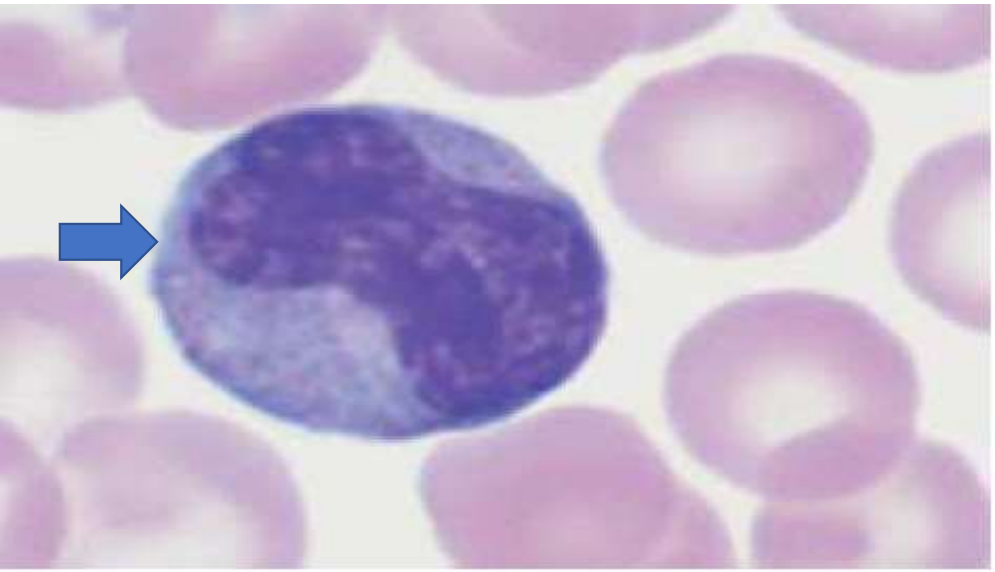


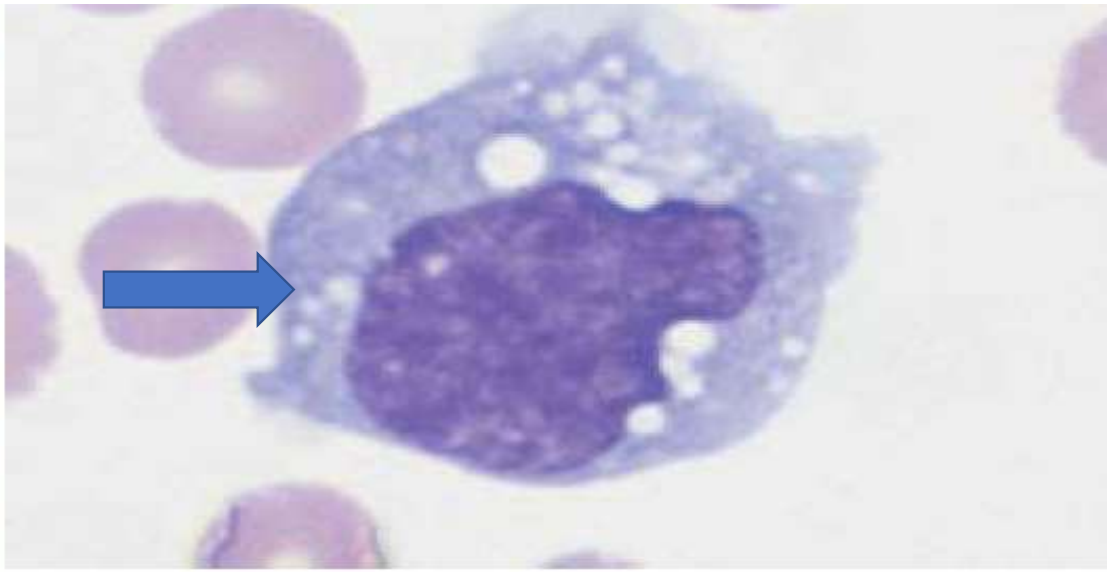
Name

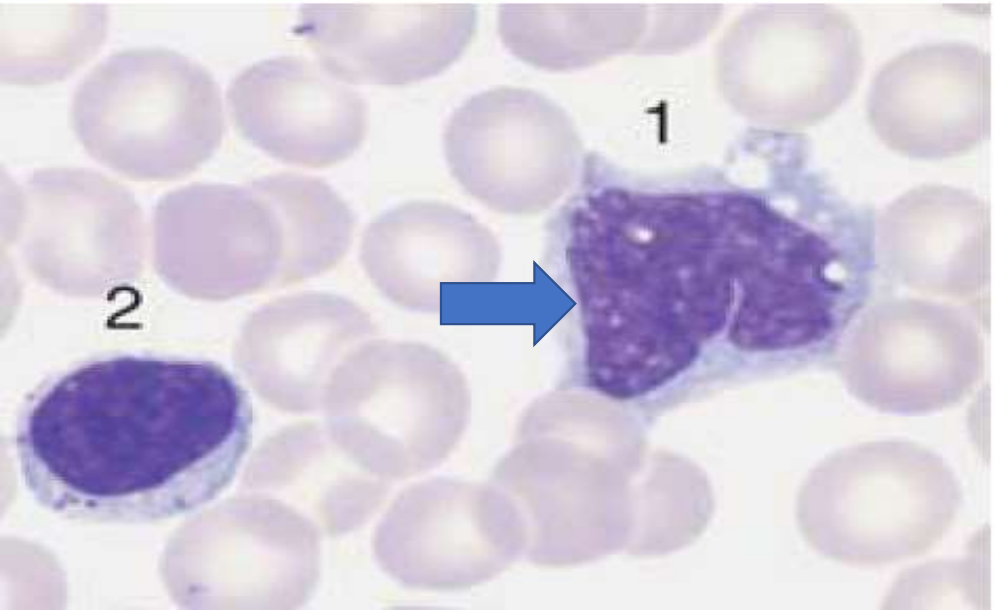




NEUTROPHILS
BACTERIAL INFECTION



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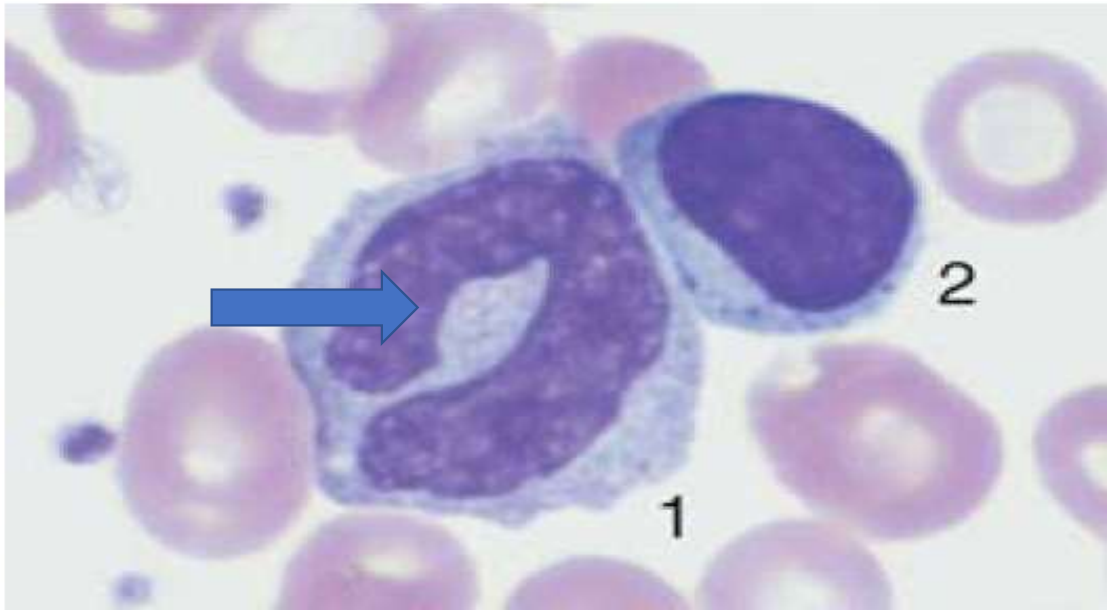
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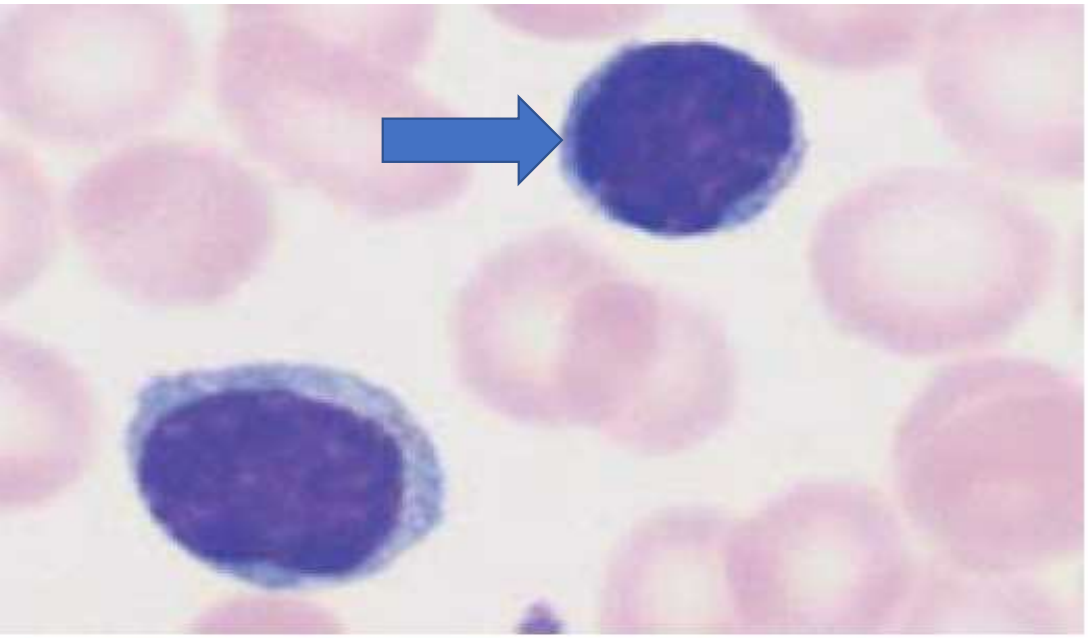
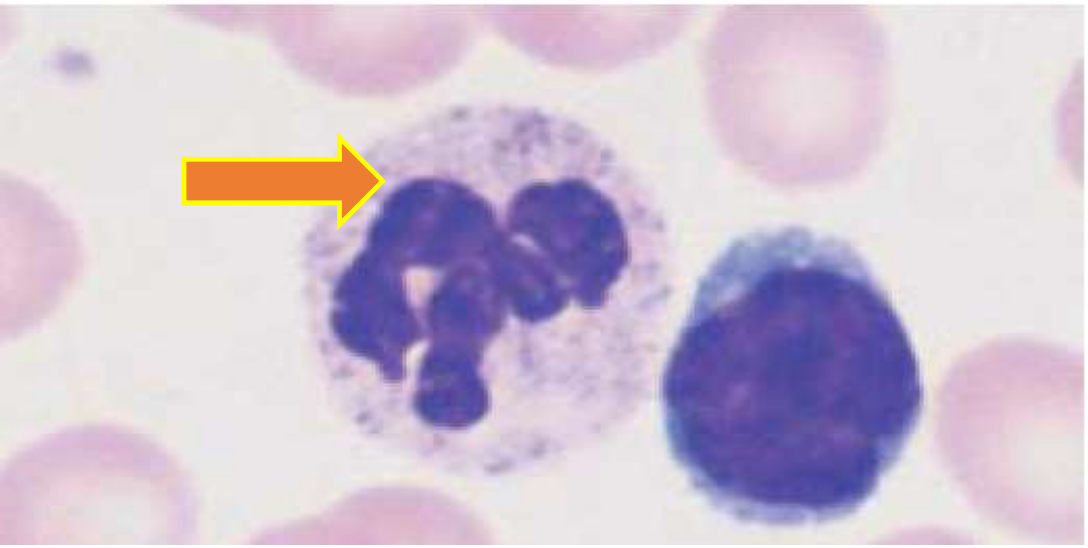
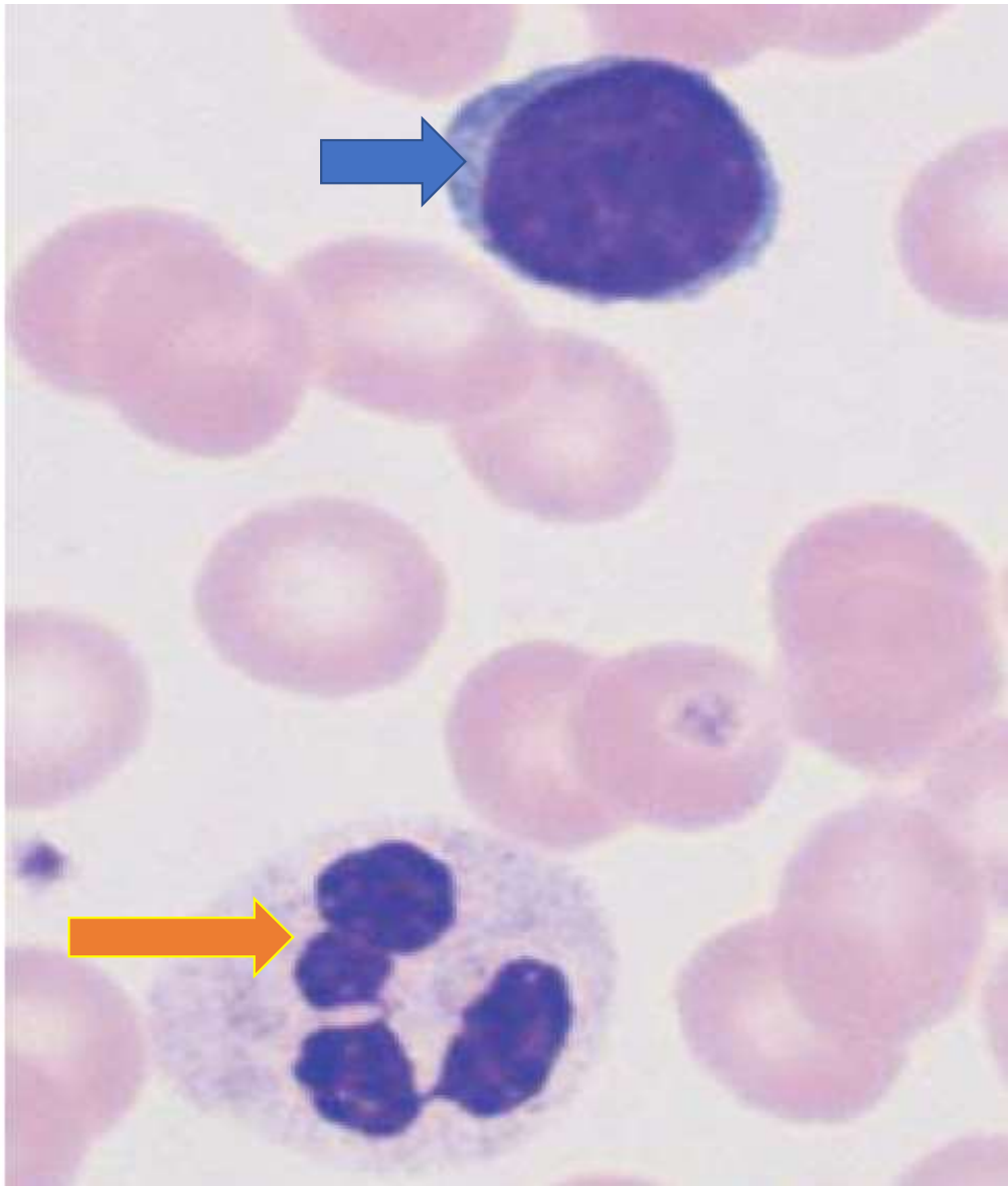
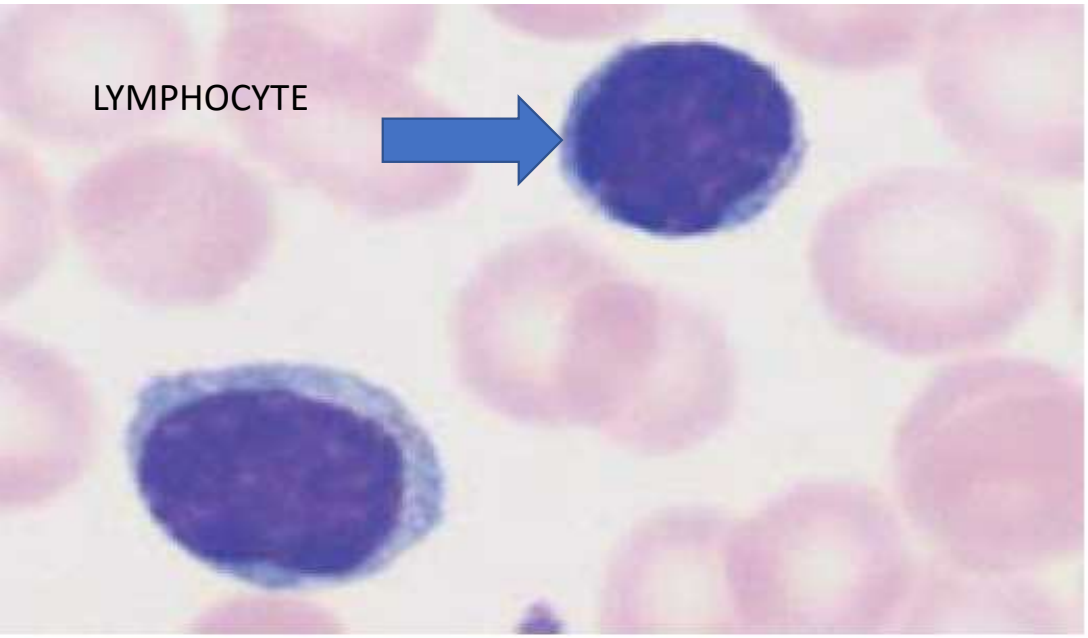
MONOCYTES





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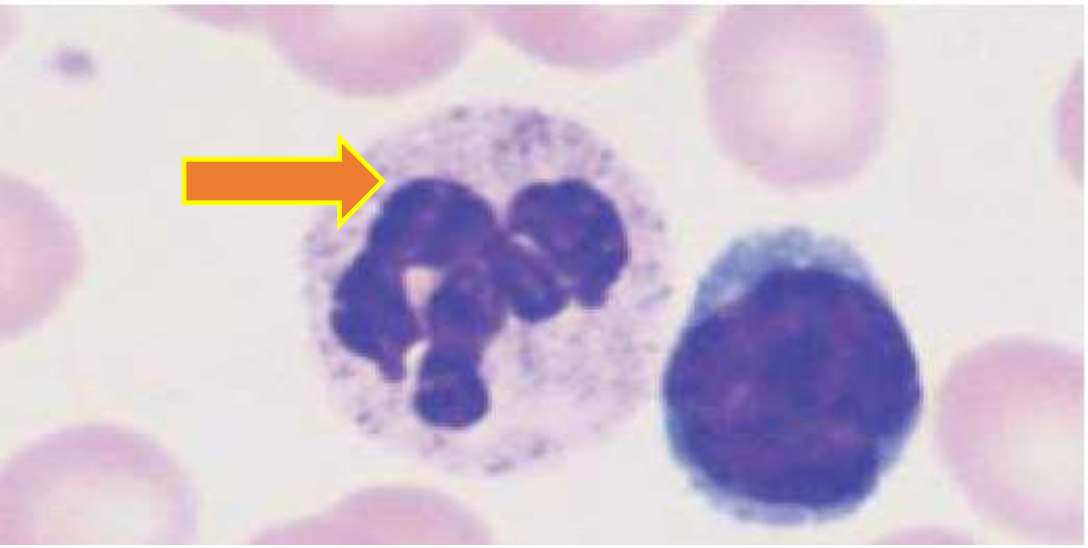
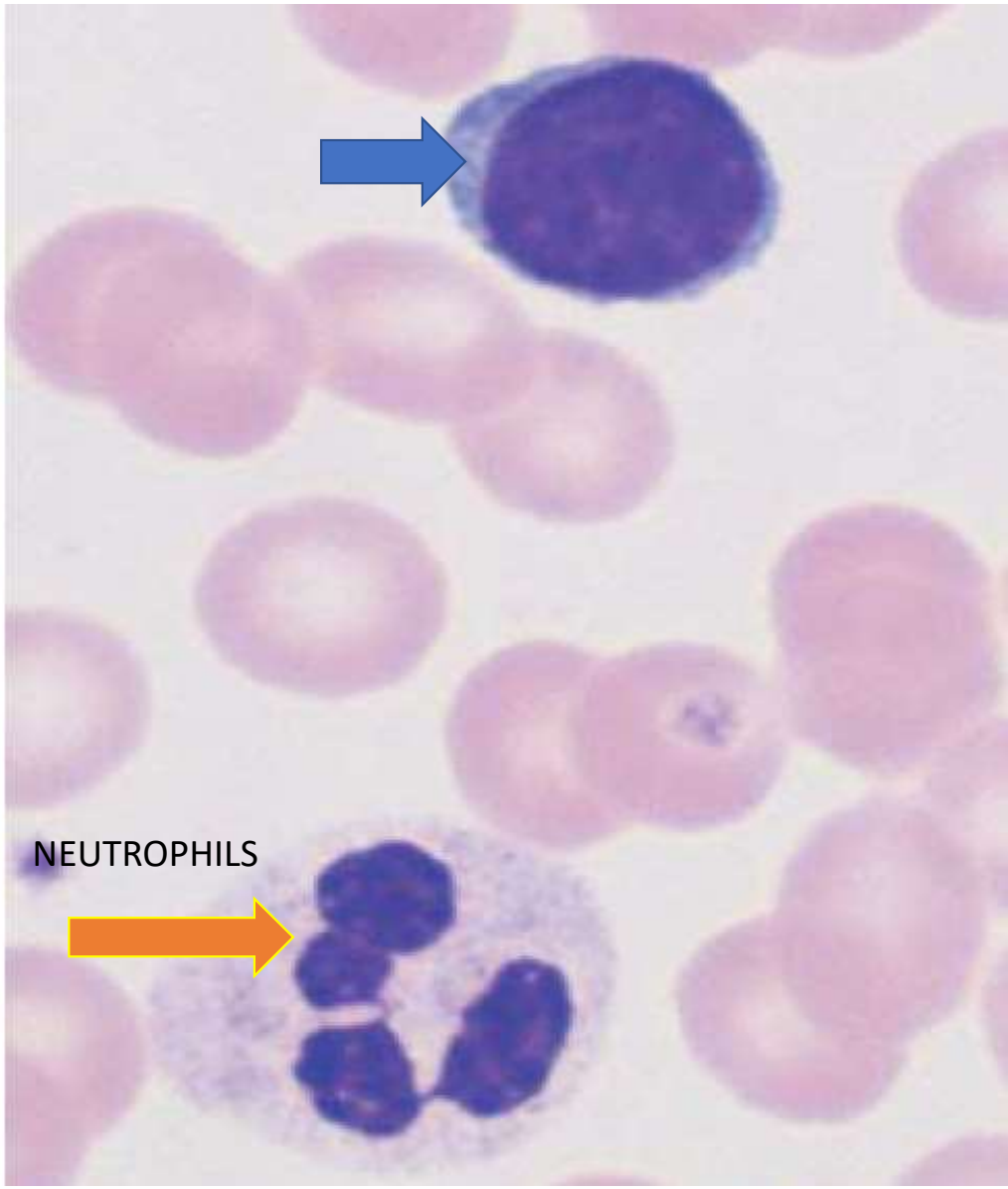
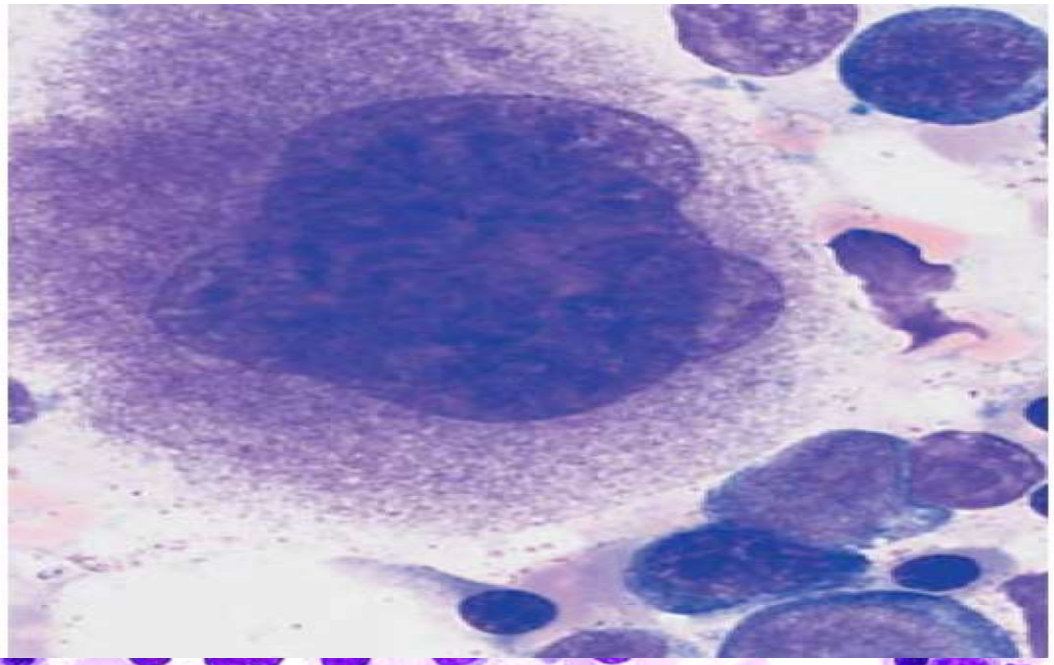
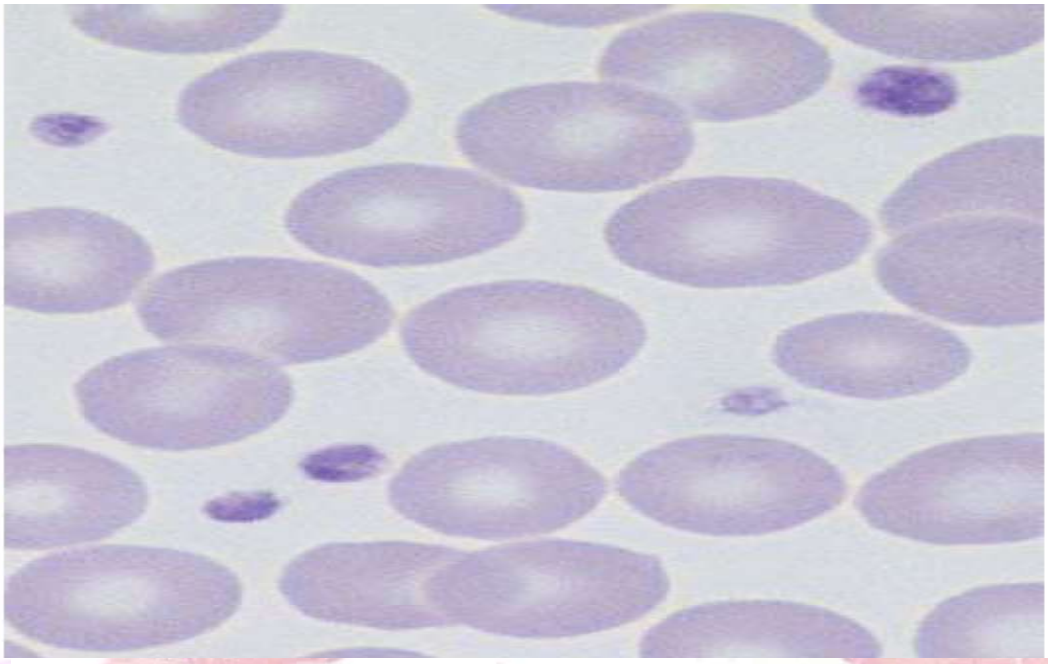
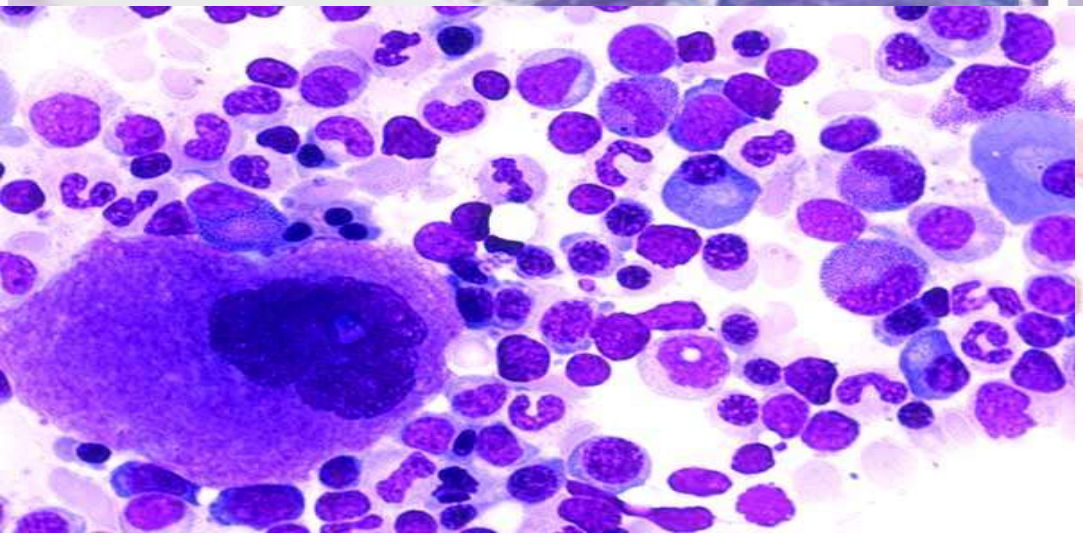
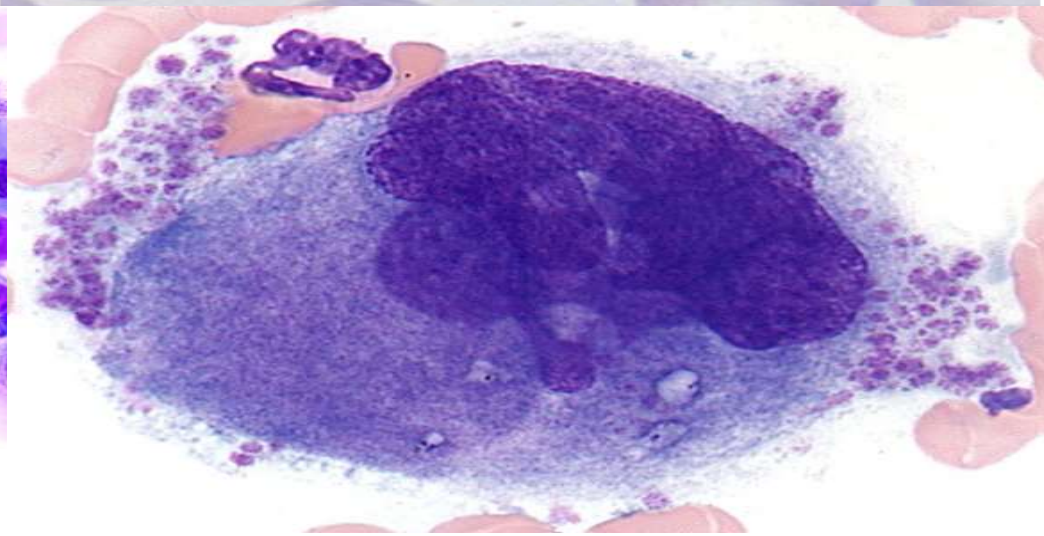


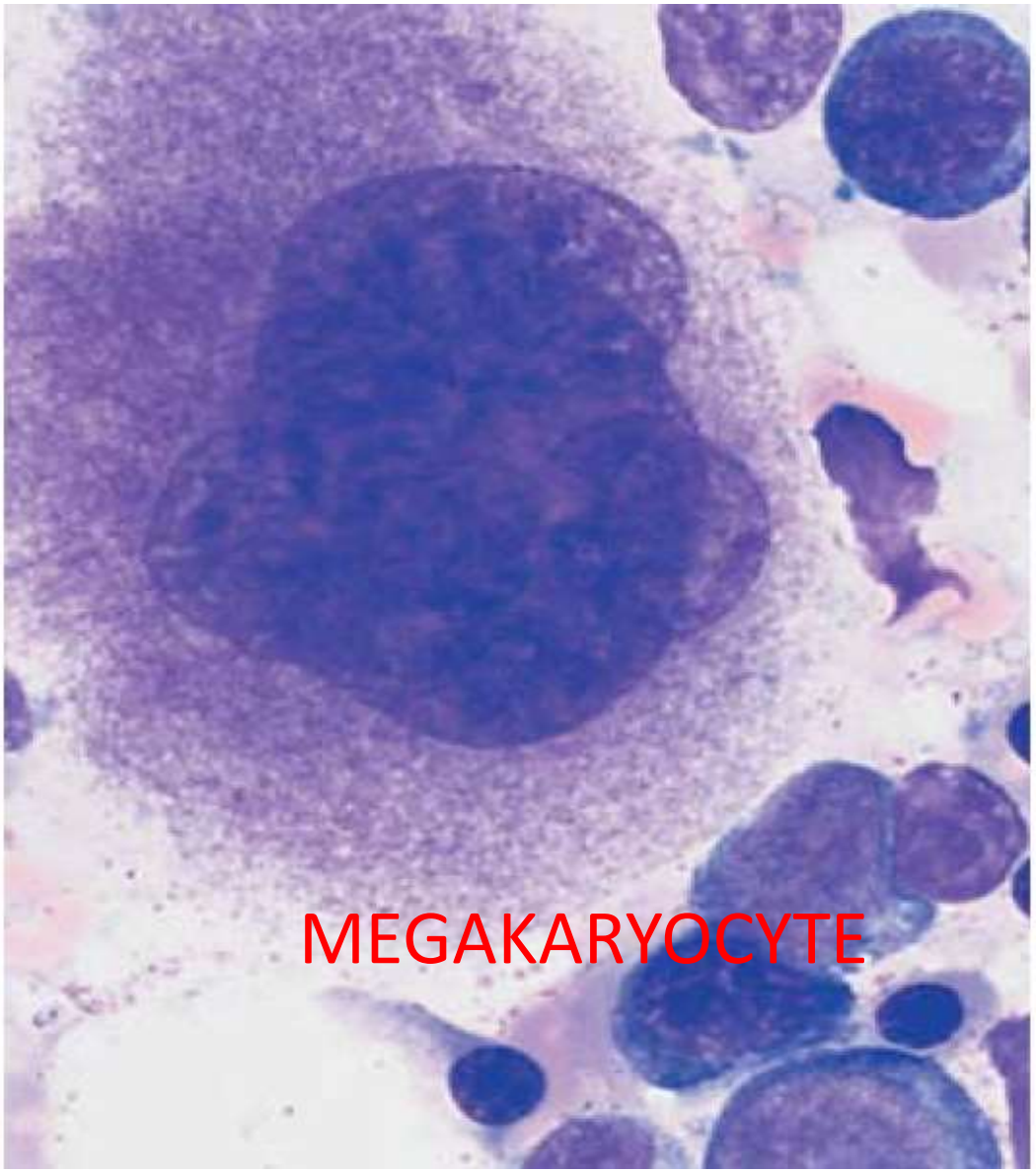

NEUTROPHILS

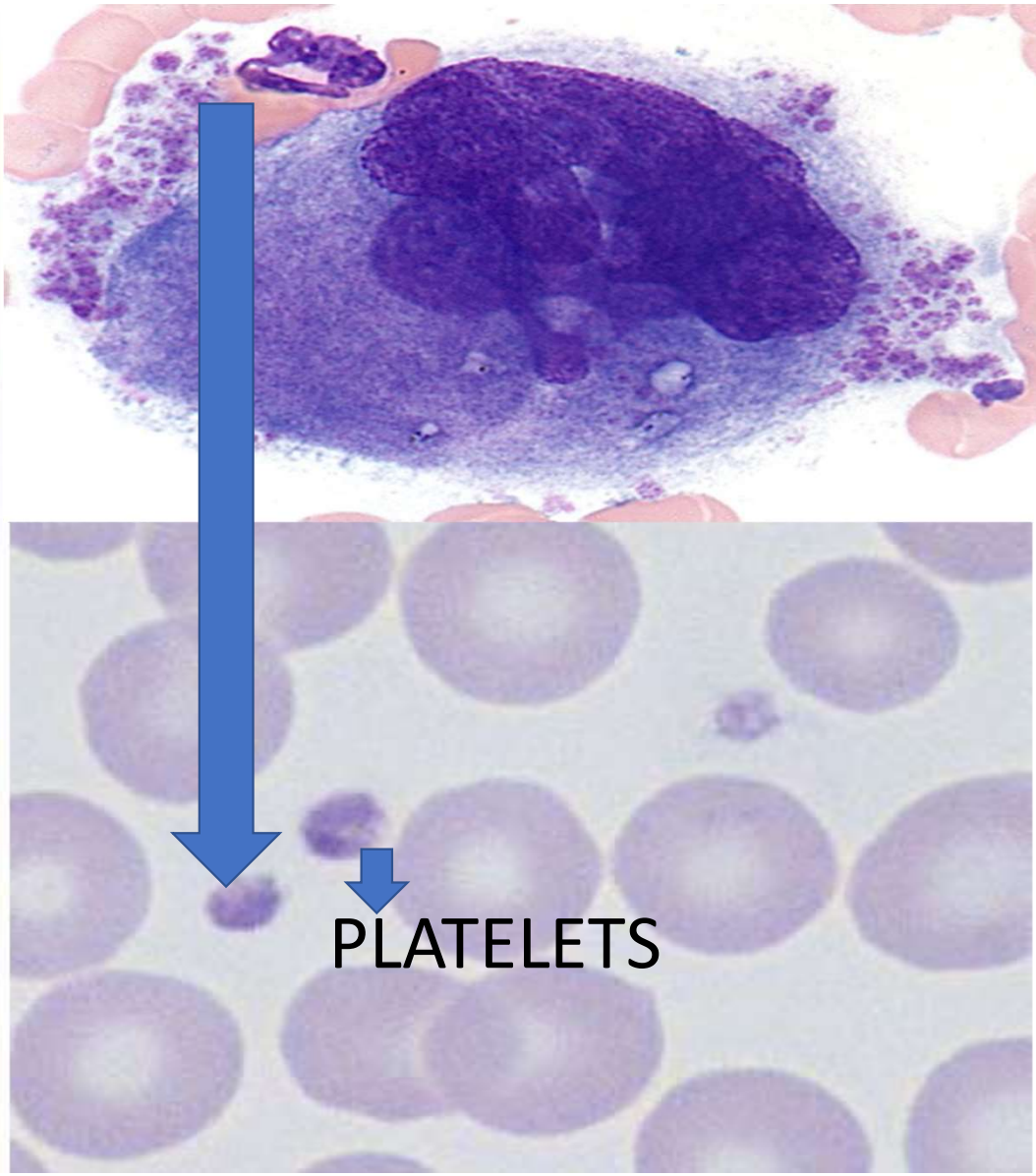


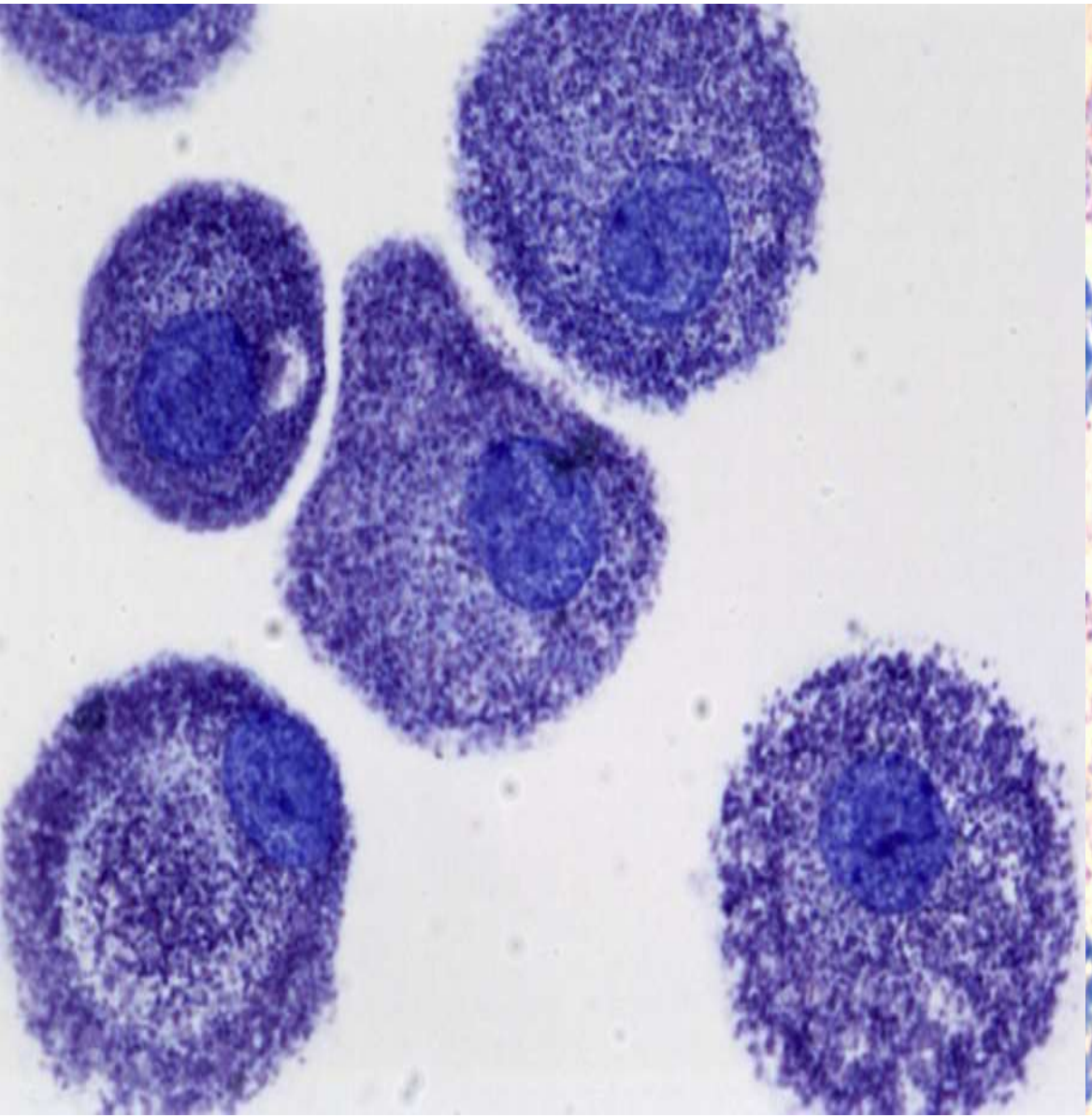


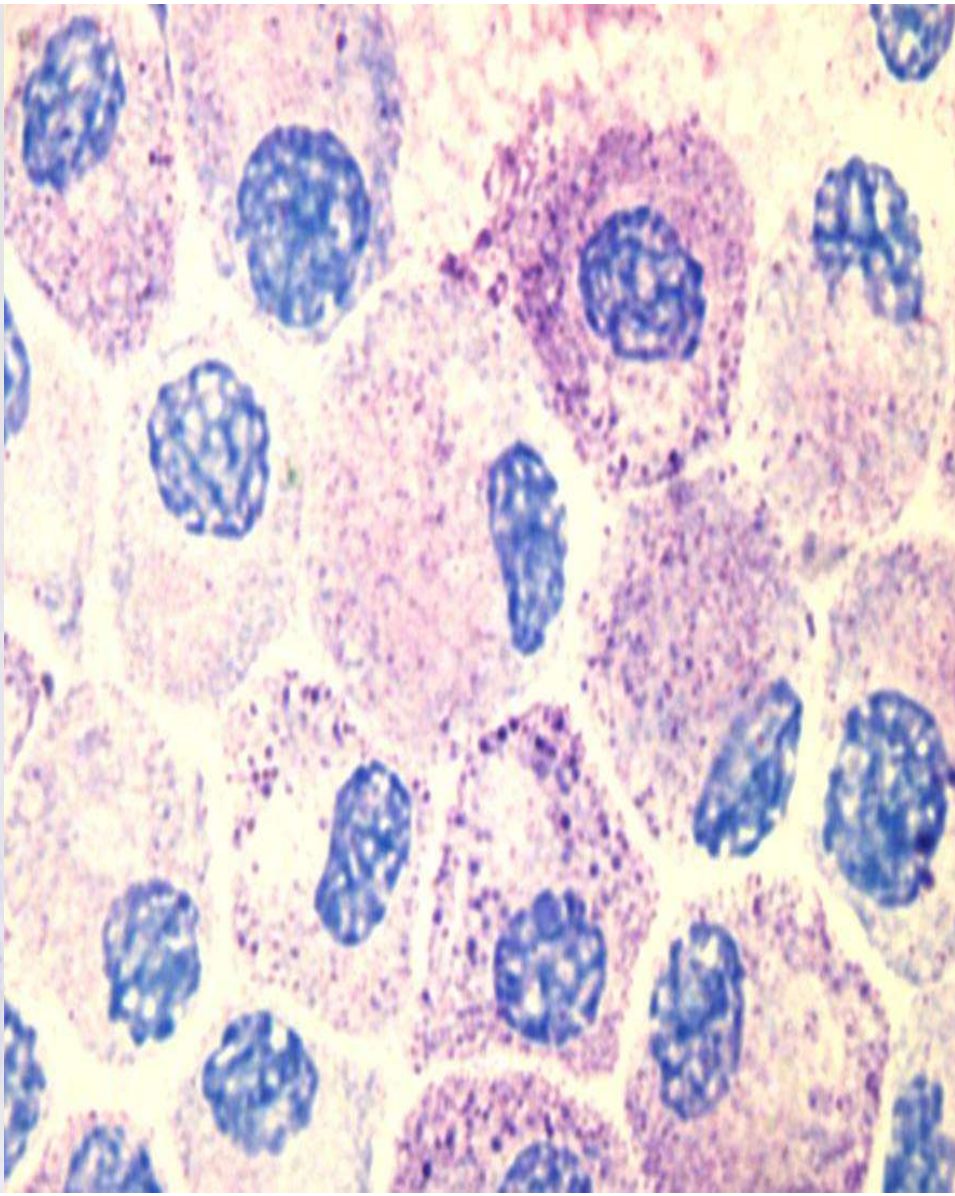





MEGAKARYOCYTE


PLATELETS





Human Mast Cells Under Microscope

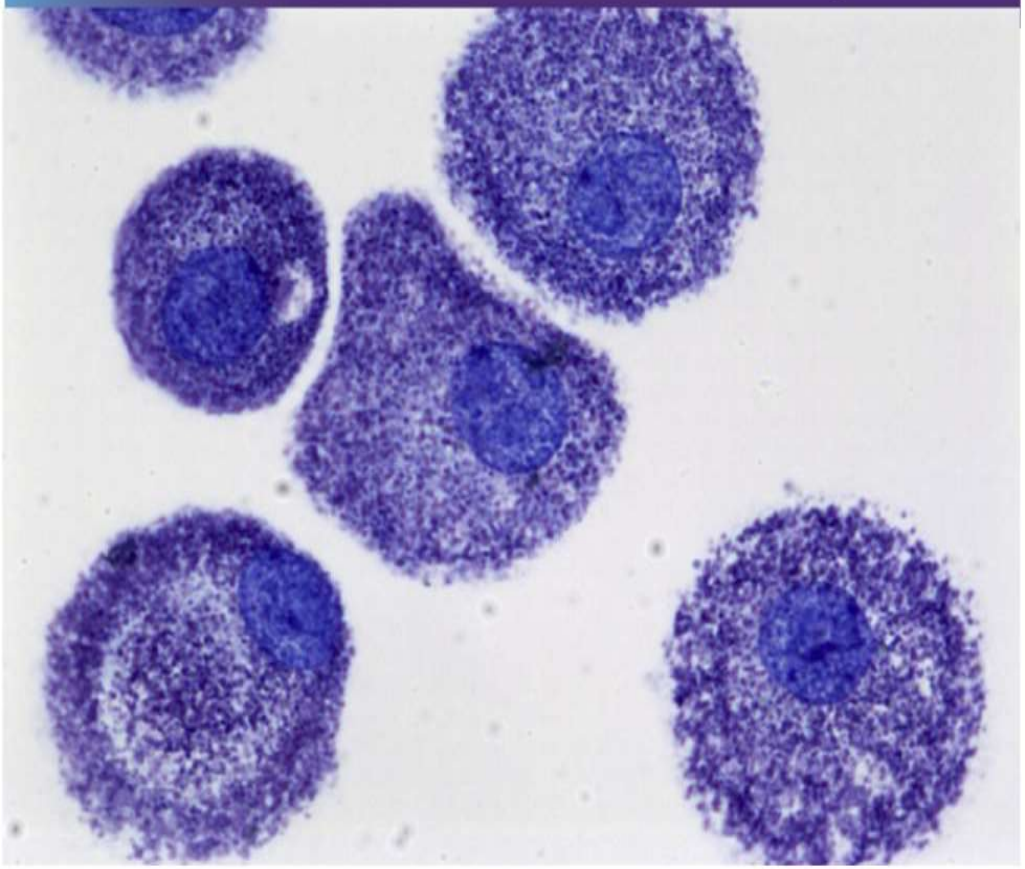
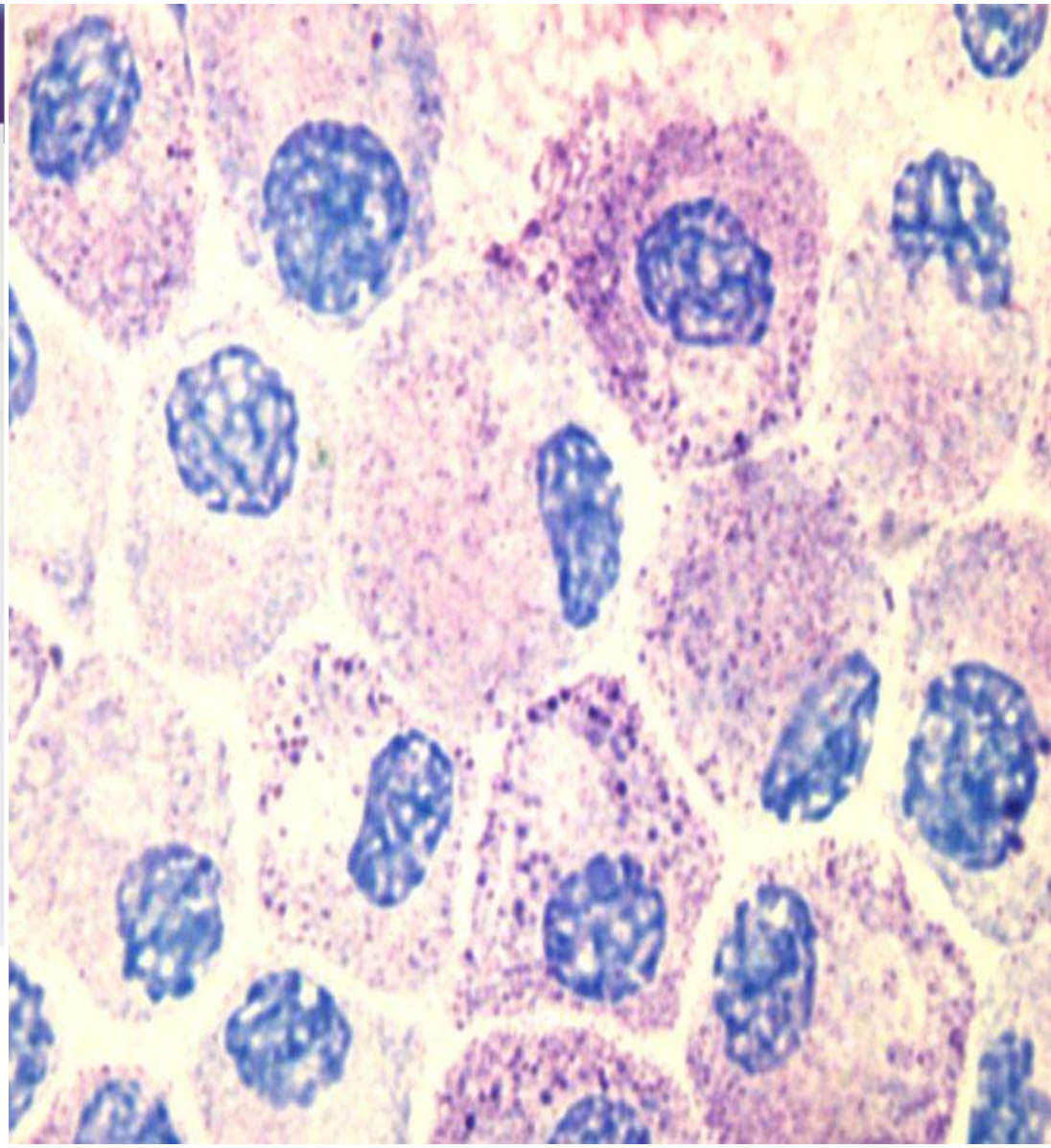
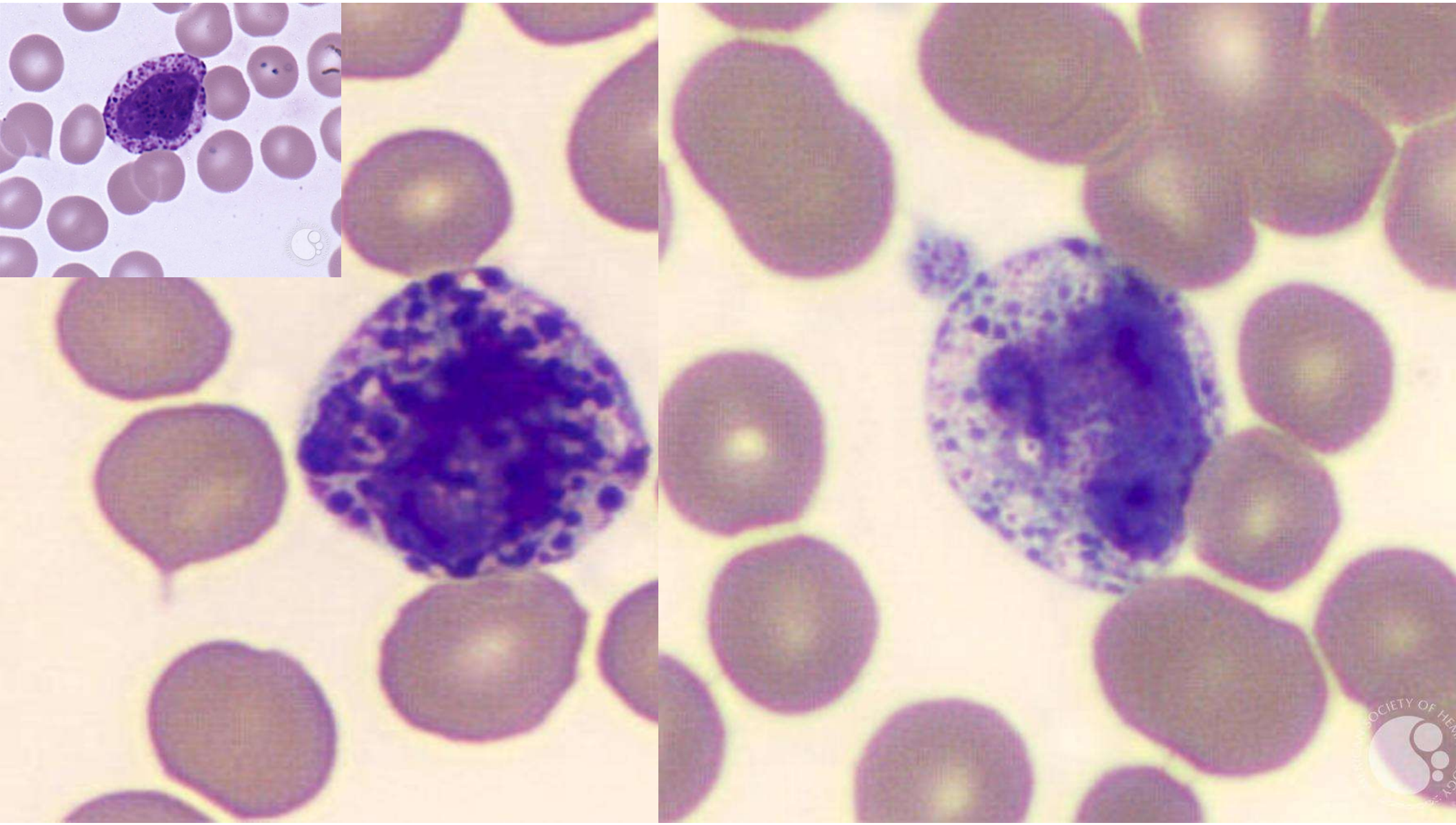
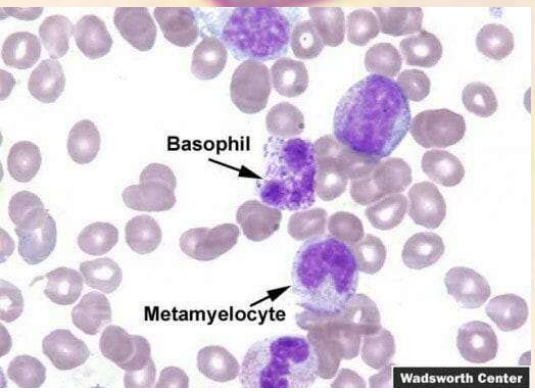


Image credit: Madeleine K. Radinger ,
National Institute of Allergy and Infectious Diseases,
National Institutes of Health (LAD/NIAID/NIH).



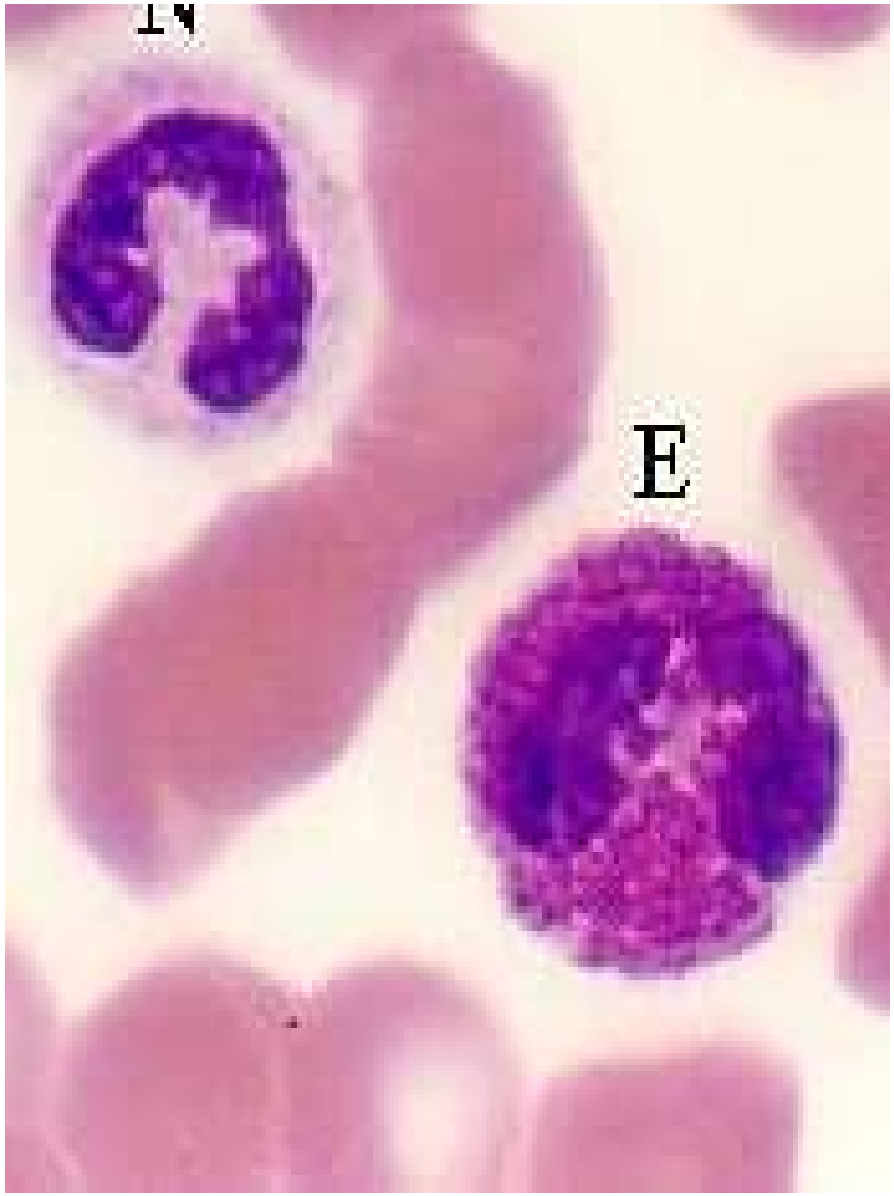


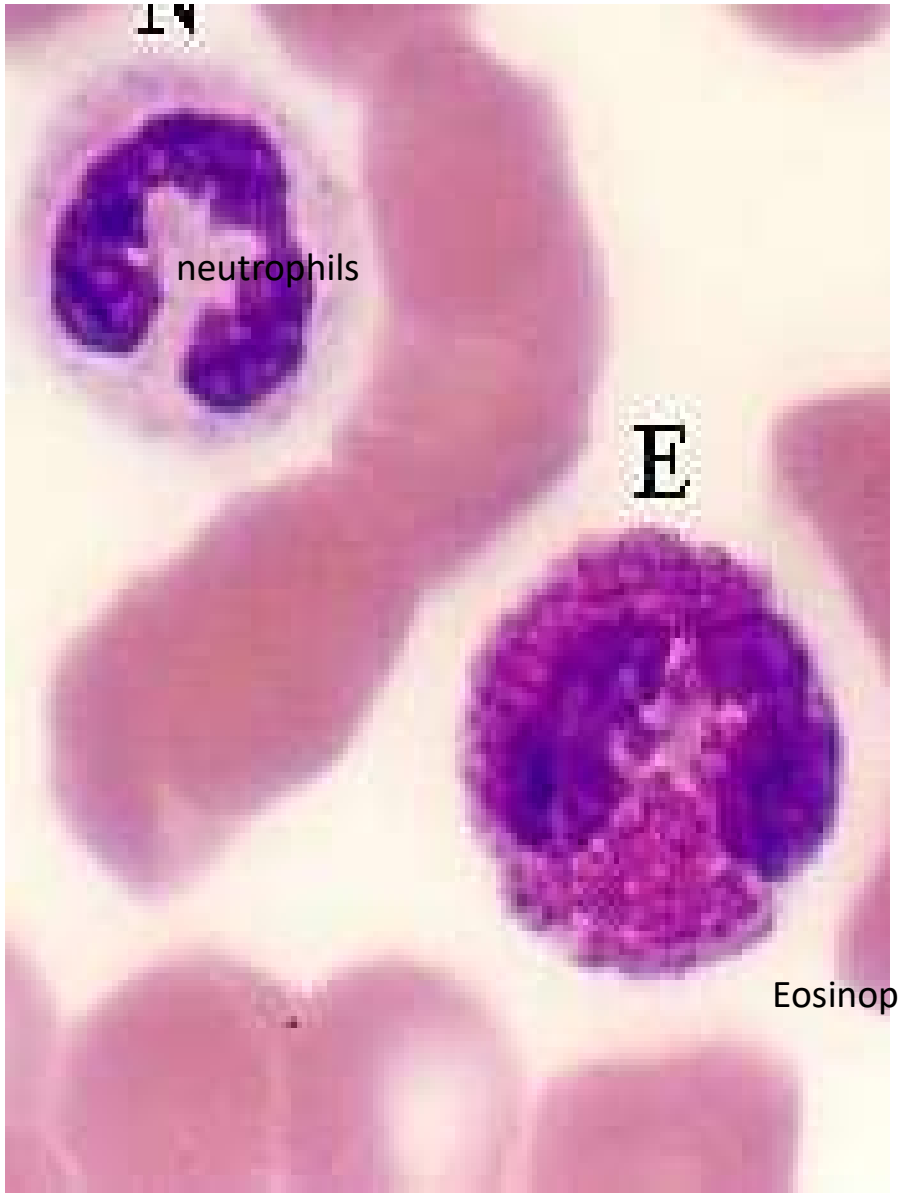
BASOPHILS



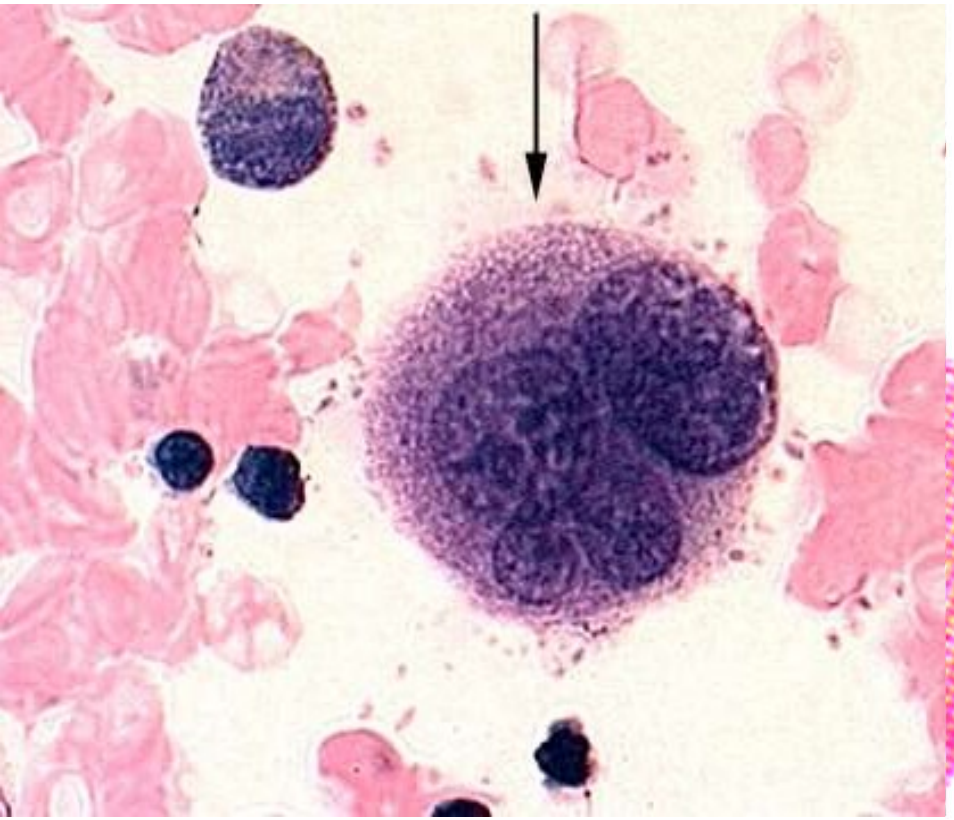
END OF CHALLENGE

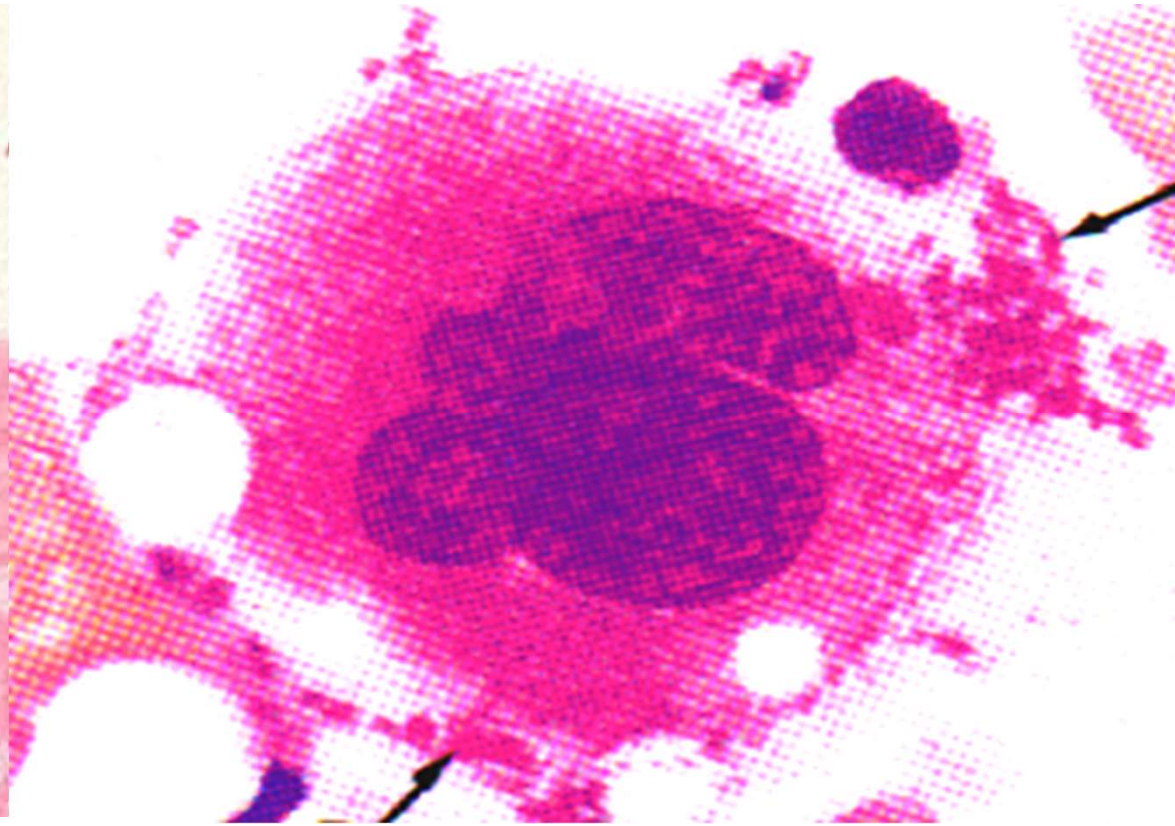
8/What
are the cells?



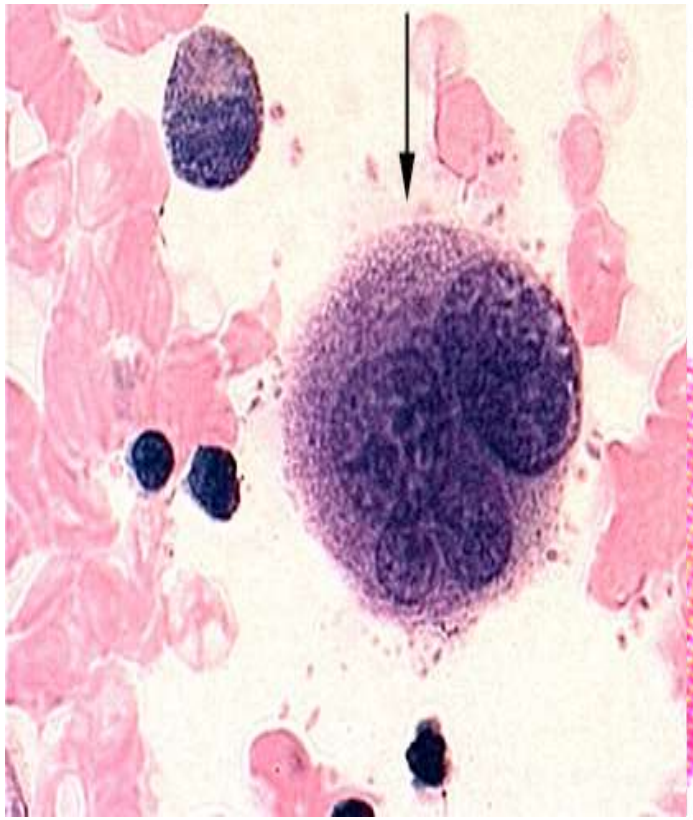


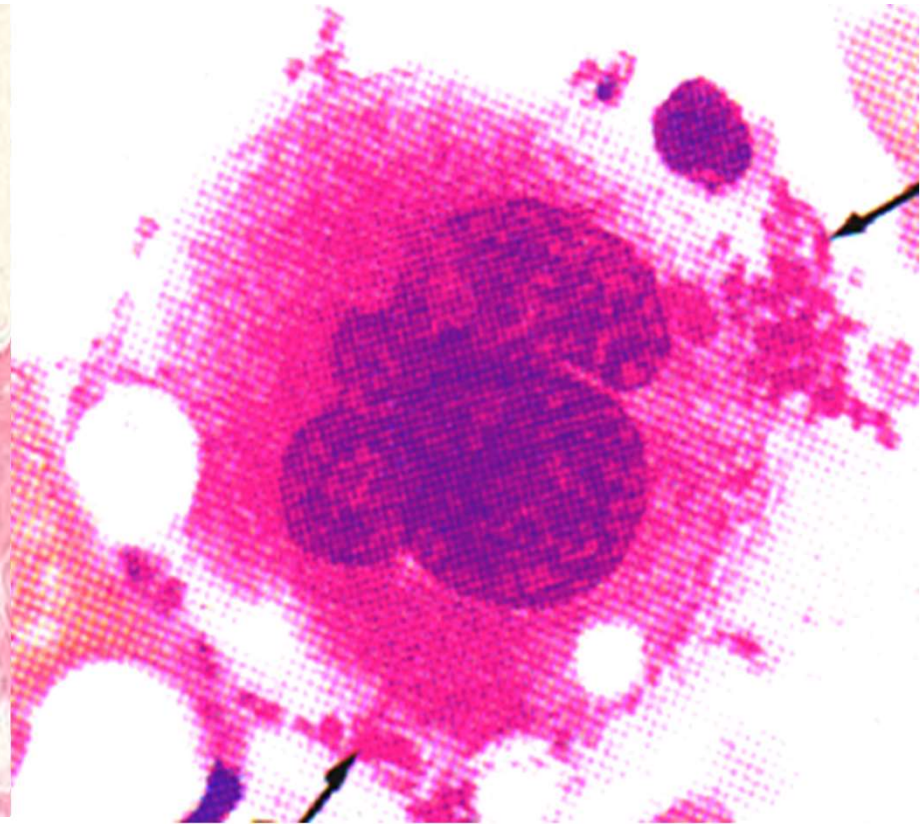
Eosinophils ,





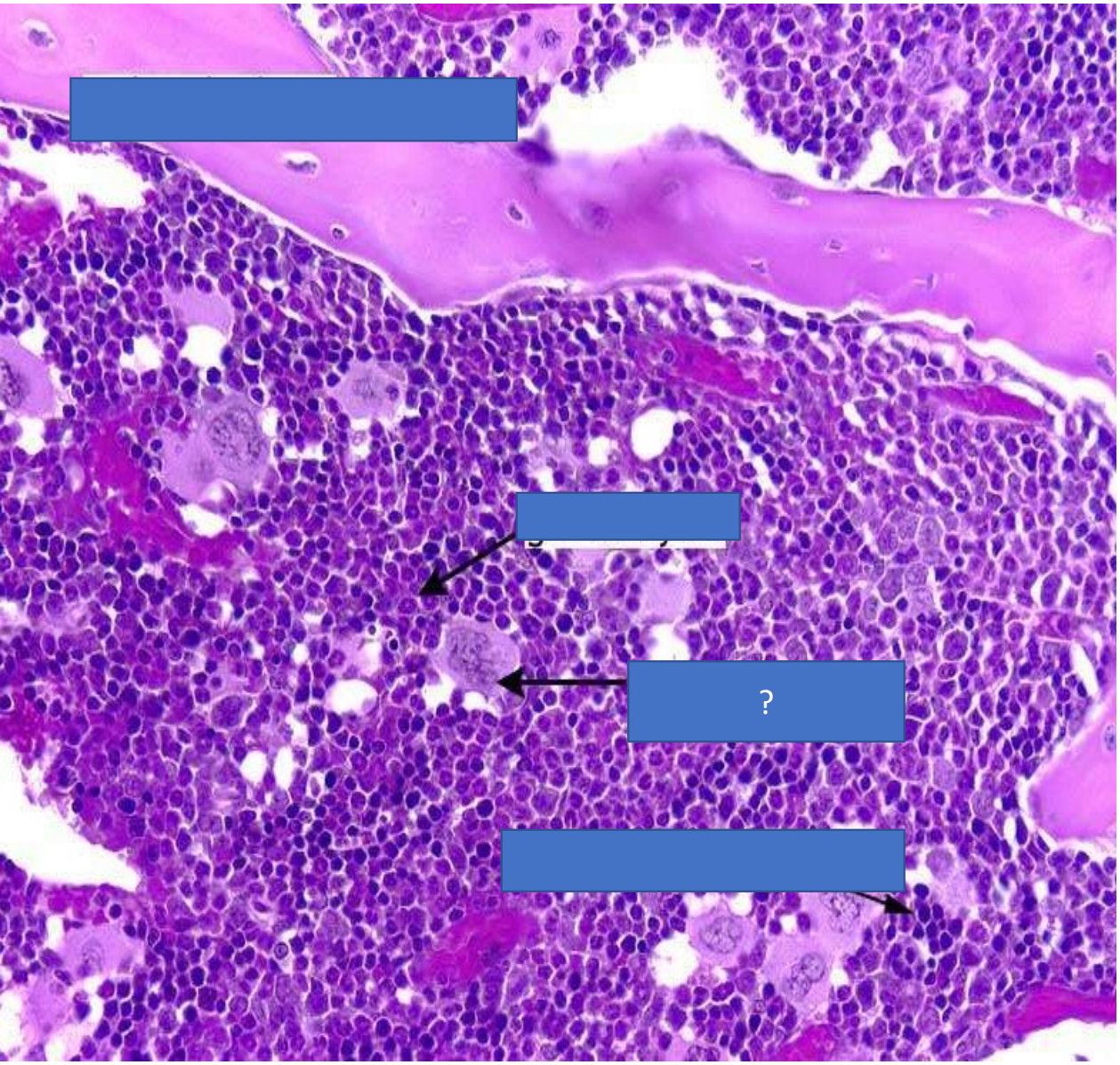
10/IDENTIFY THIS CELL OR FUNCTION OR ORIGIN , THE CHOICE IS YOURS?



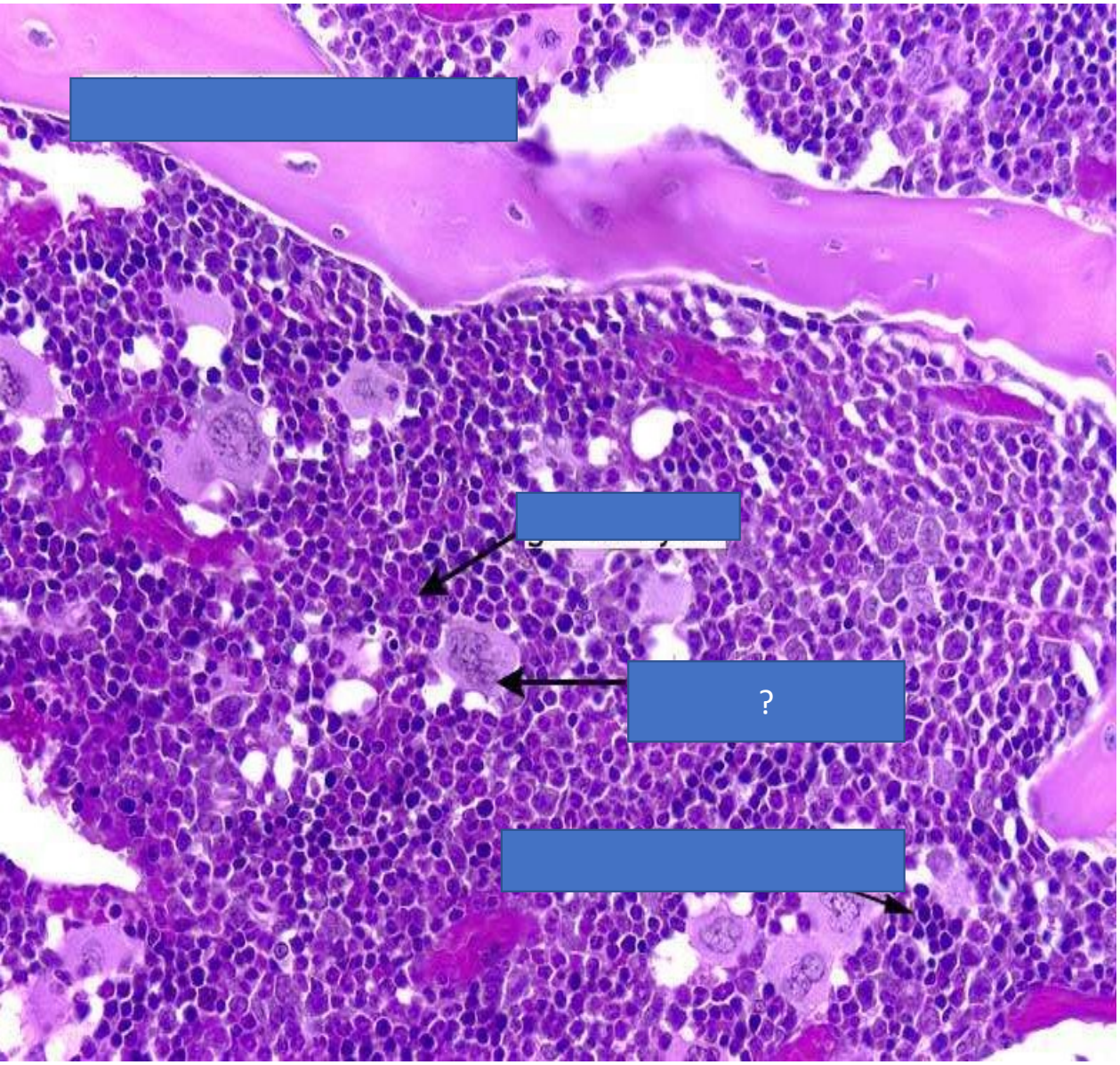


10/IDENTIFY THIS CELL OR FUNCTION OR ORIGIN , THE CHOICE IS YOURS?

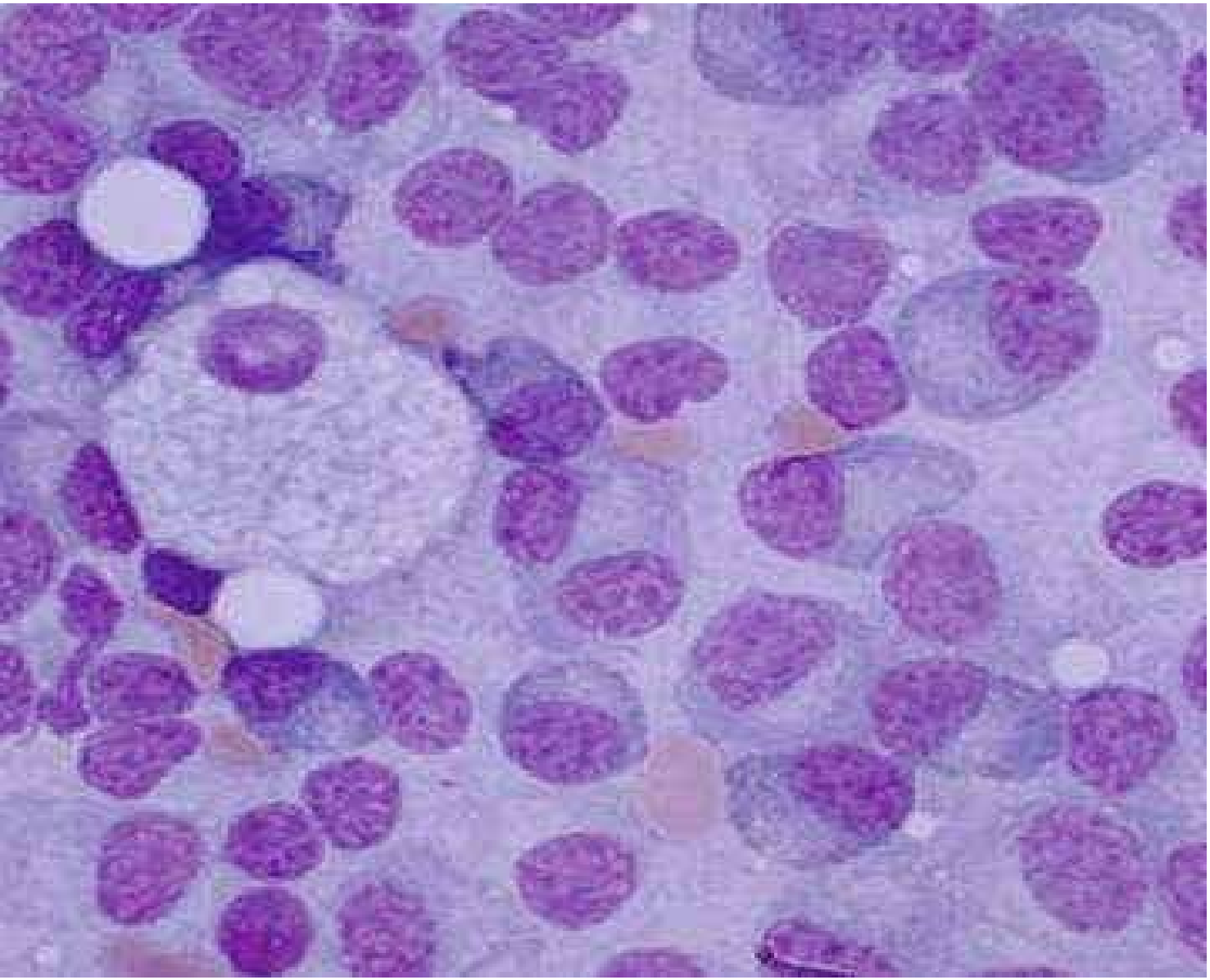
Megakaryocyte



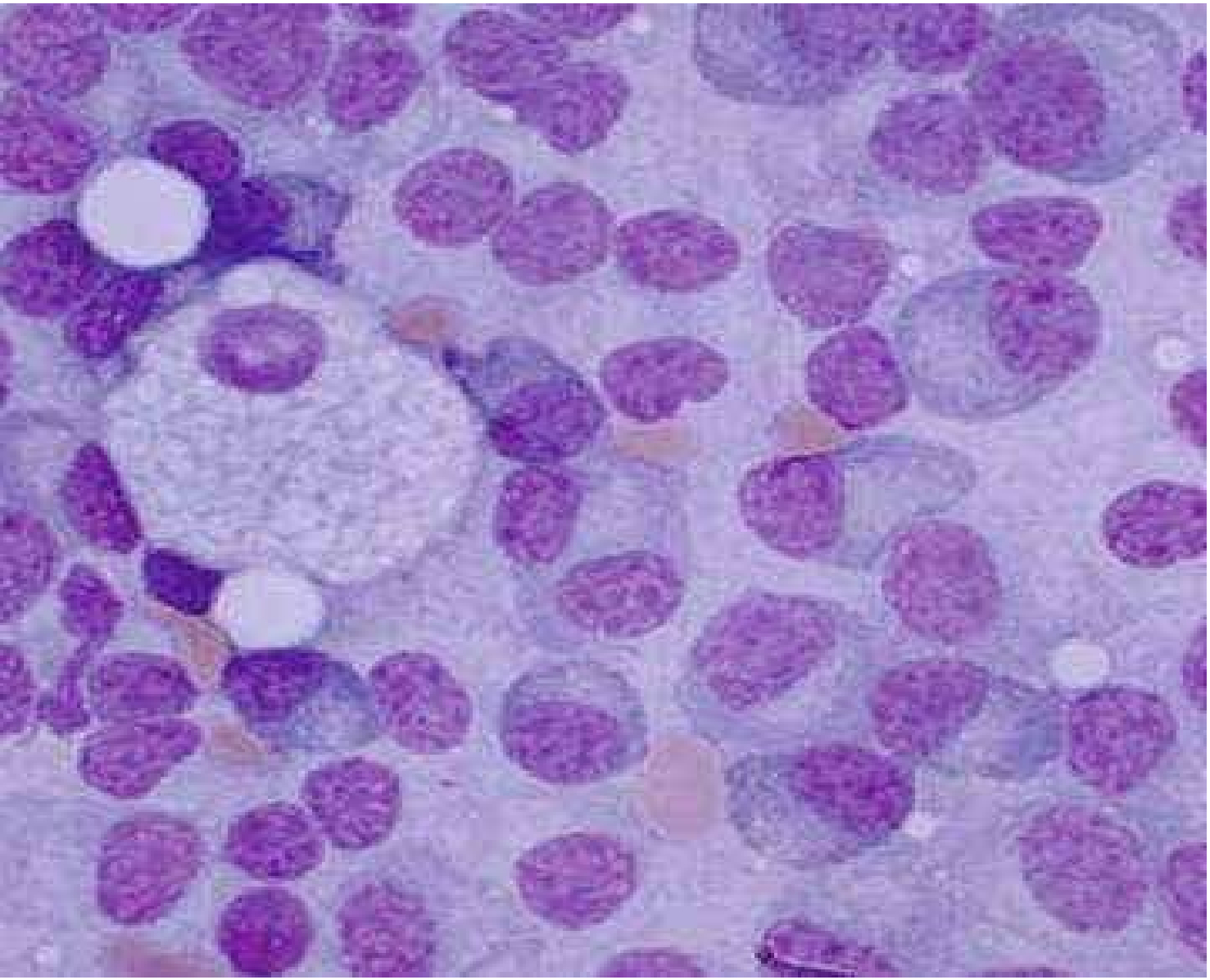
1/LOCATION OF THIS PICTURE ?



1/LOCATION OF THIS PICTURE ?
Red marrow
megakaryocyte

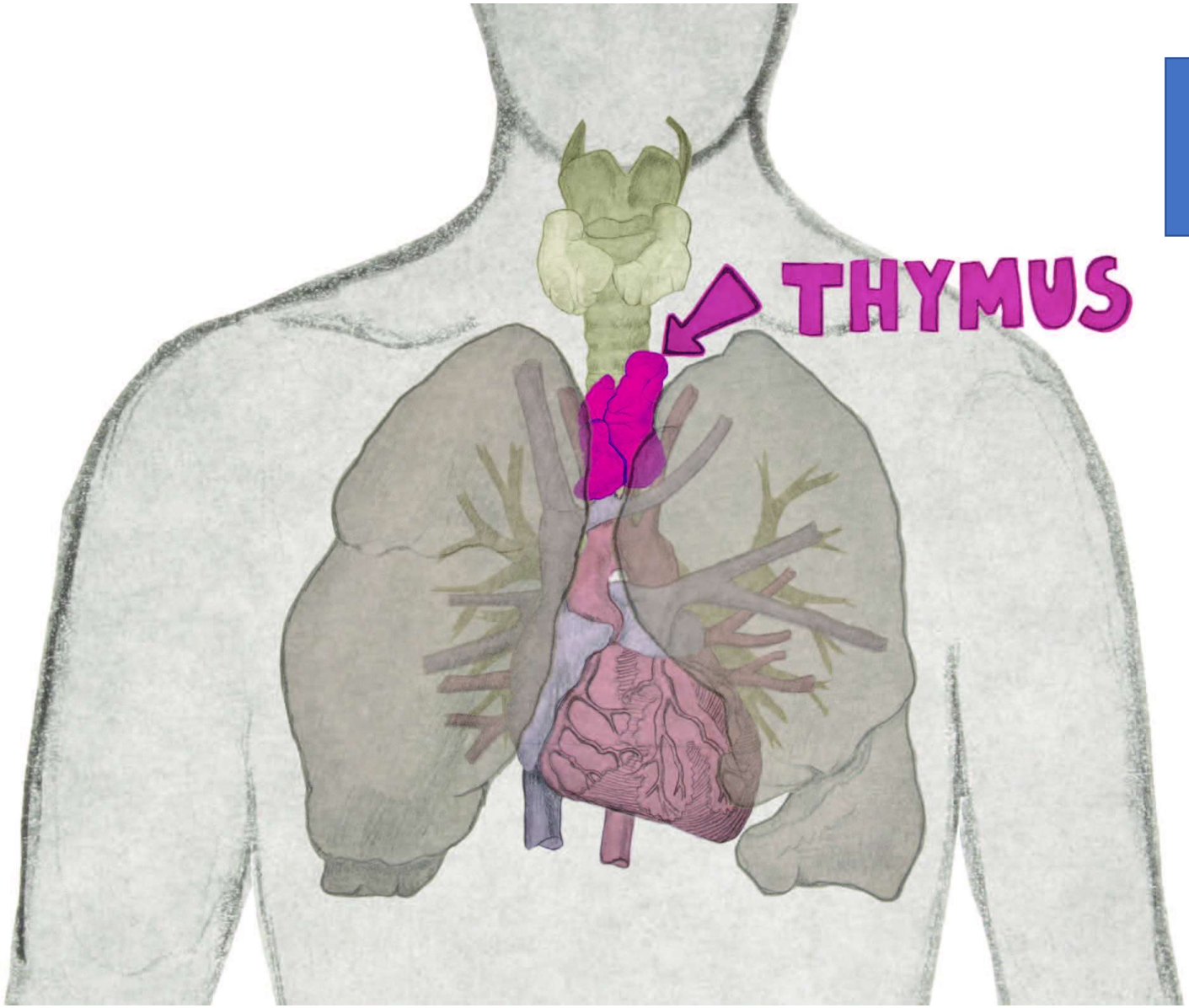


2/What is going on in here ?

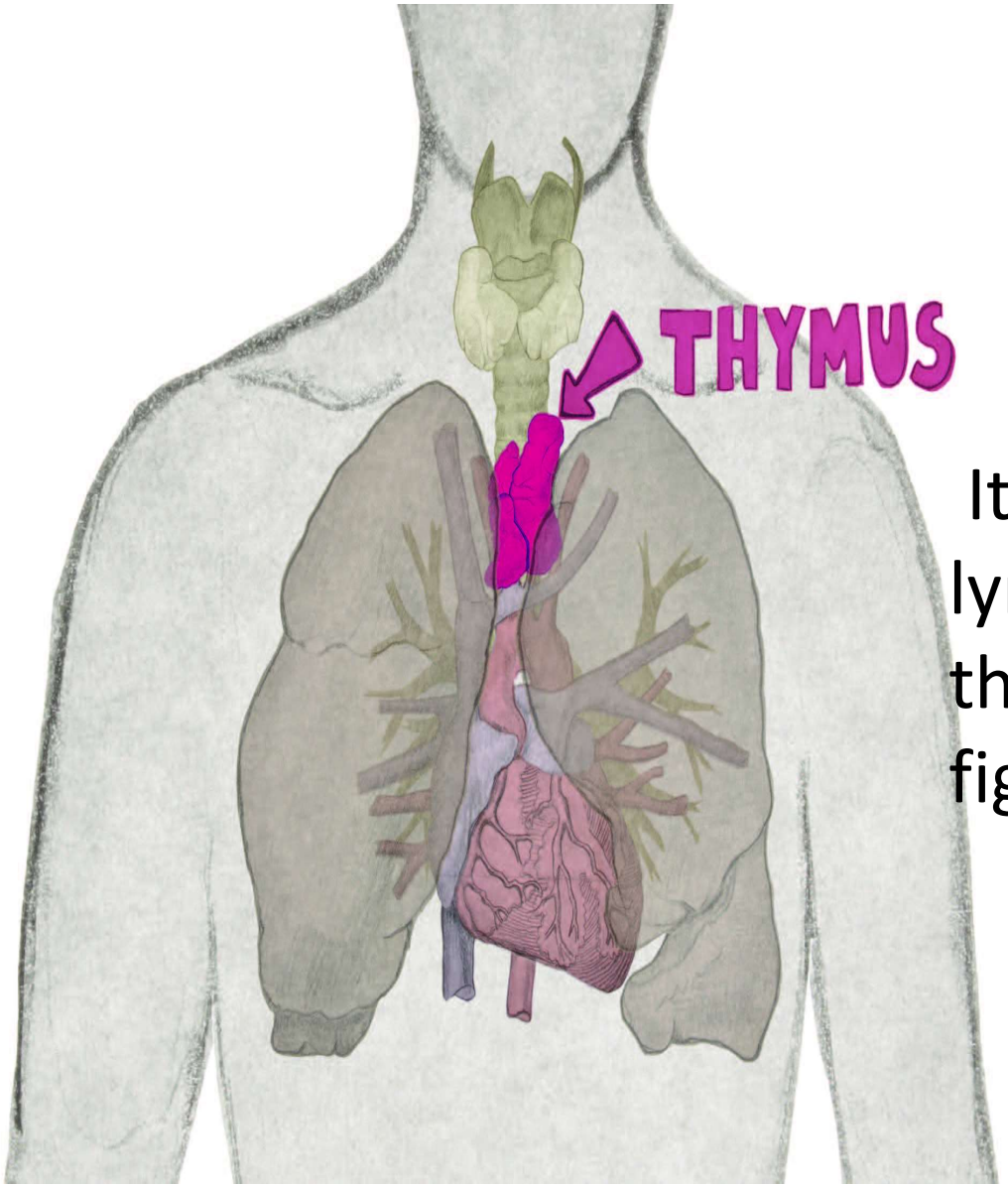


2/What is going on in here ?

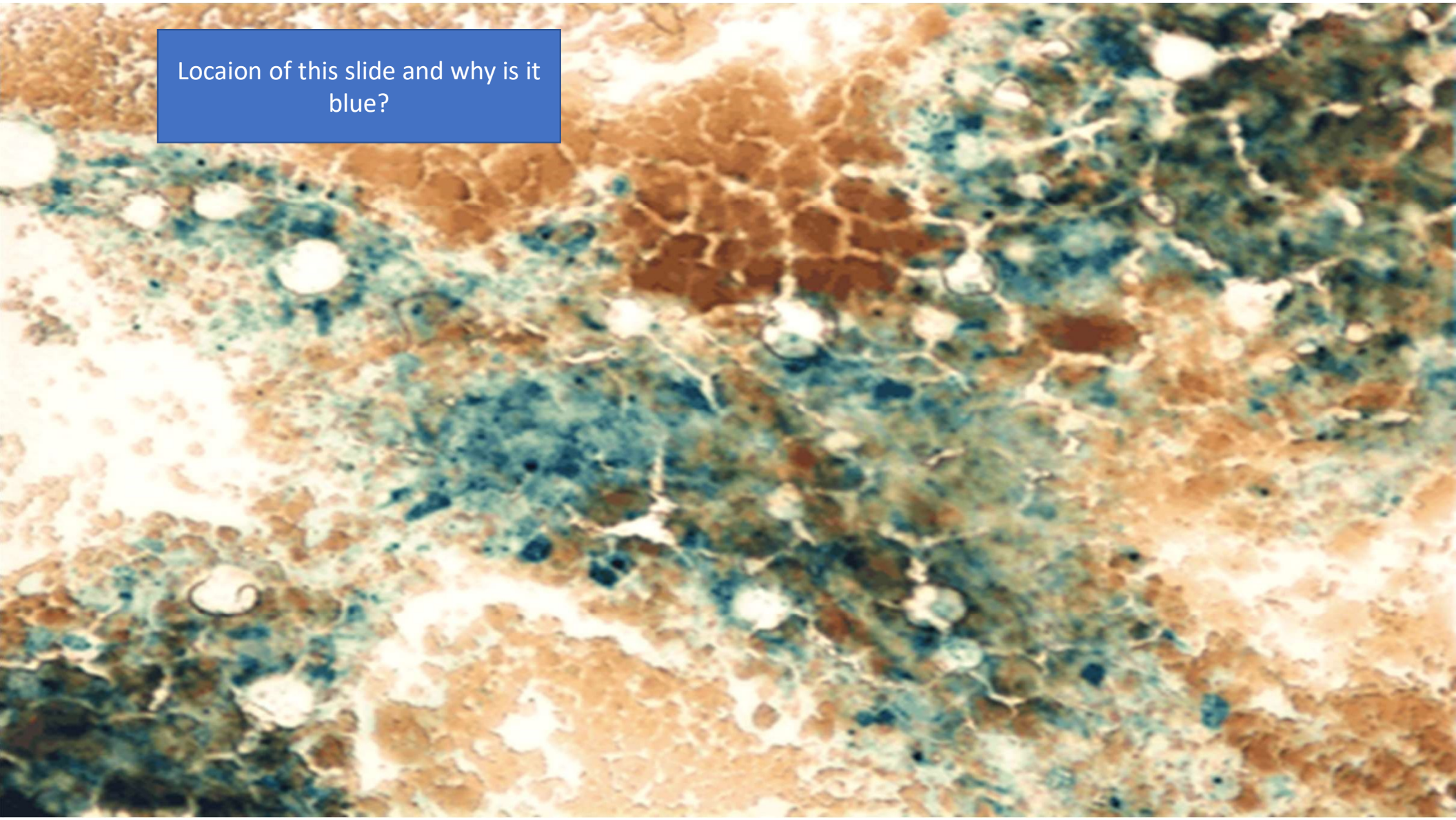
Plasma cells= ACTIVATED B lymphocytes

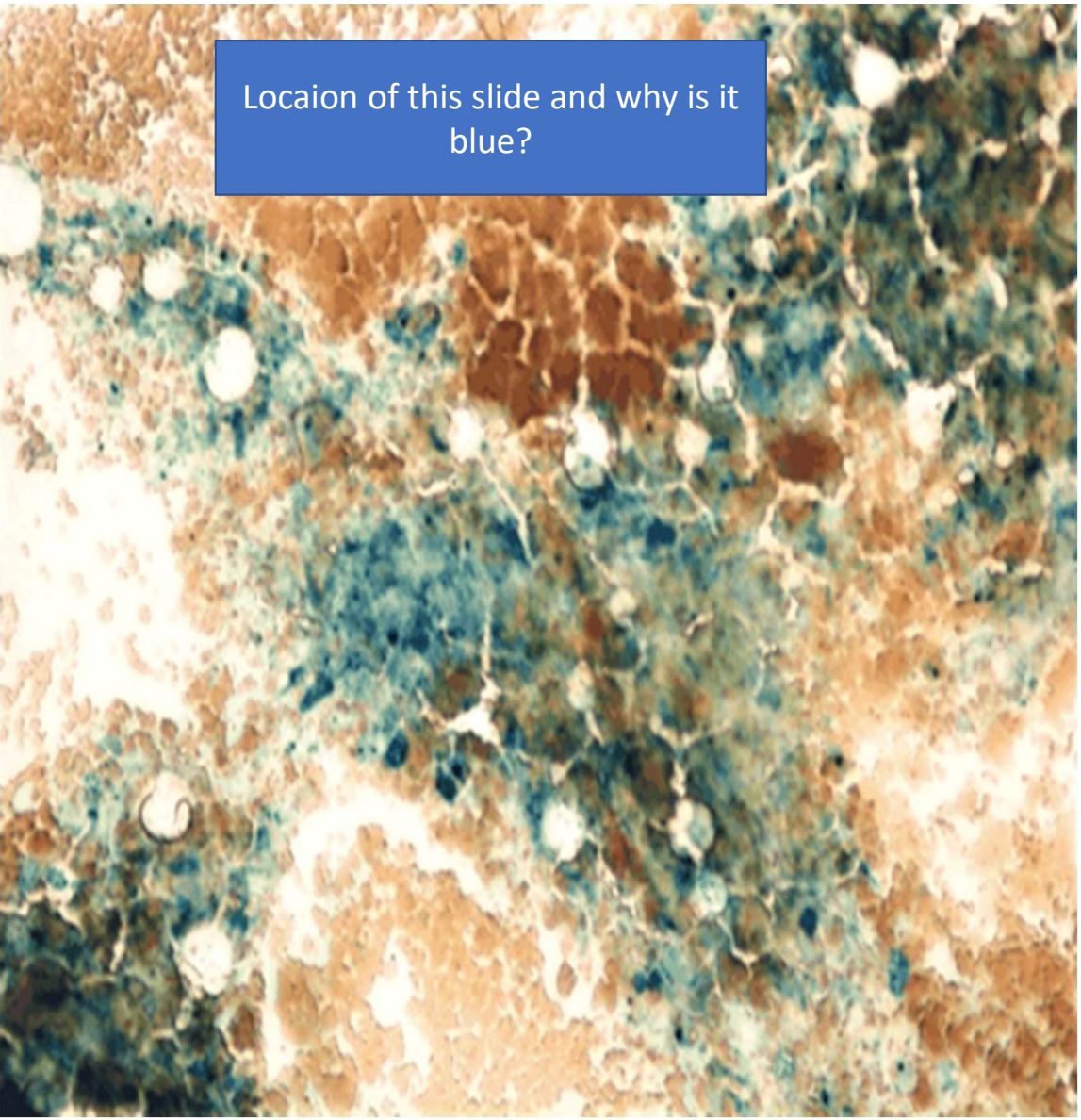


WHY THIS GLAND IS IMPORTANT?



It makes white blood cells (T lymphocytes) which are part of the immune system and help fight infection.

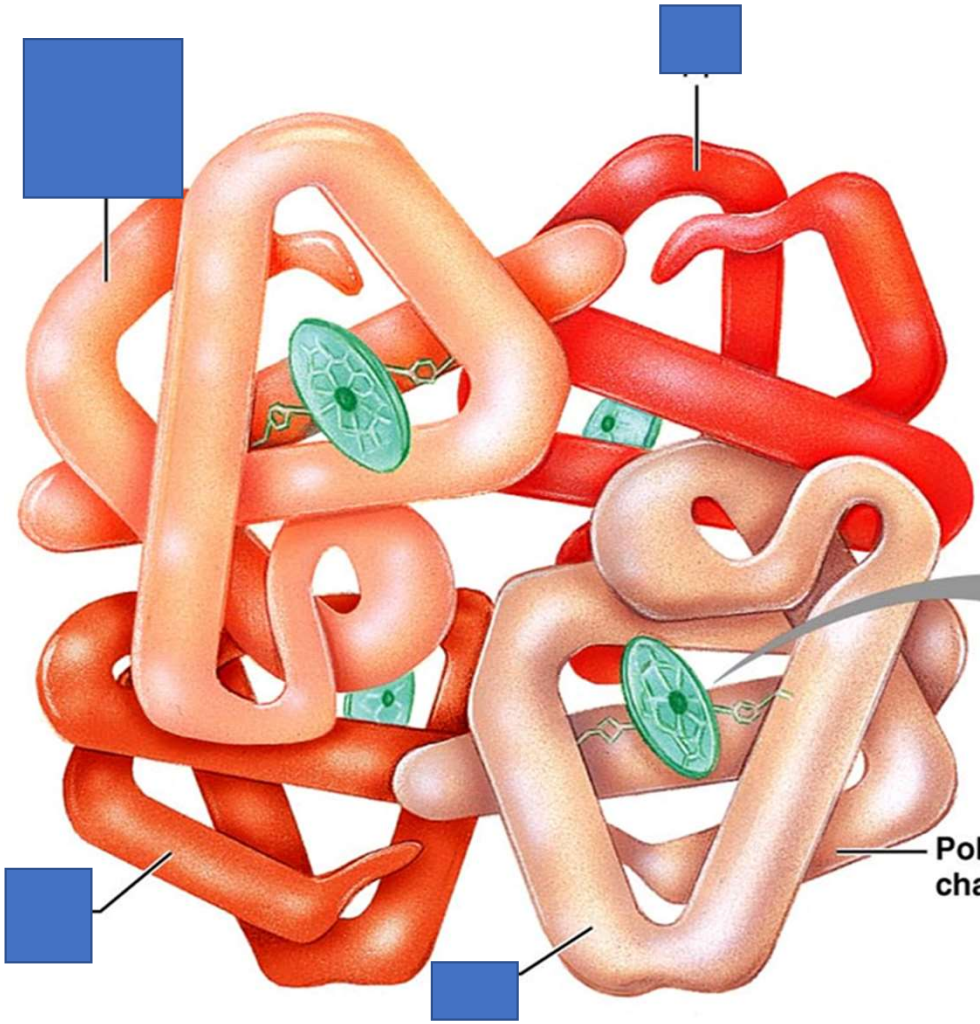

Locaion of this slide and why is it blue?

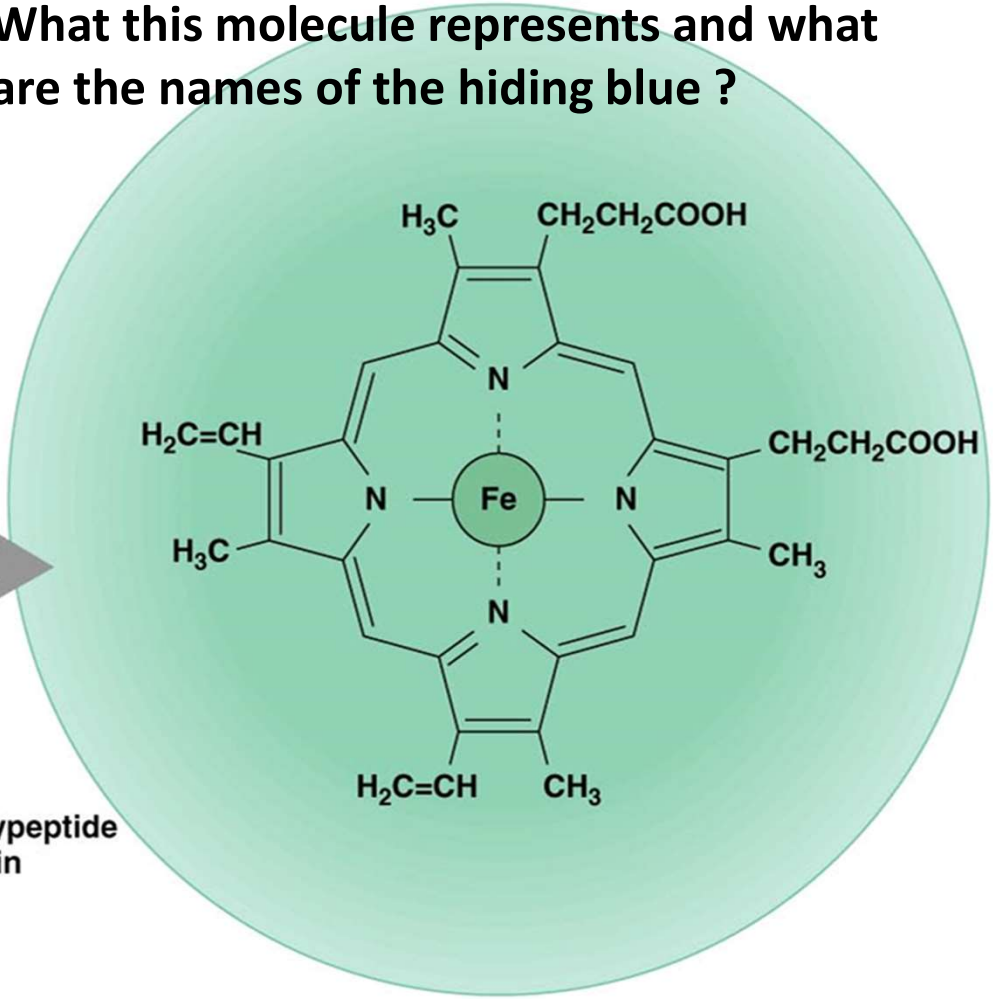


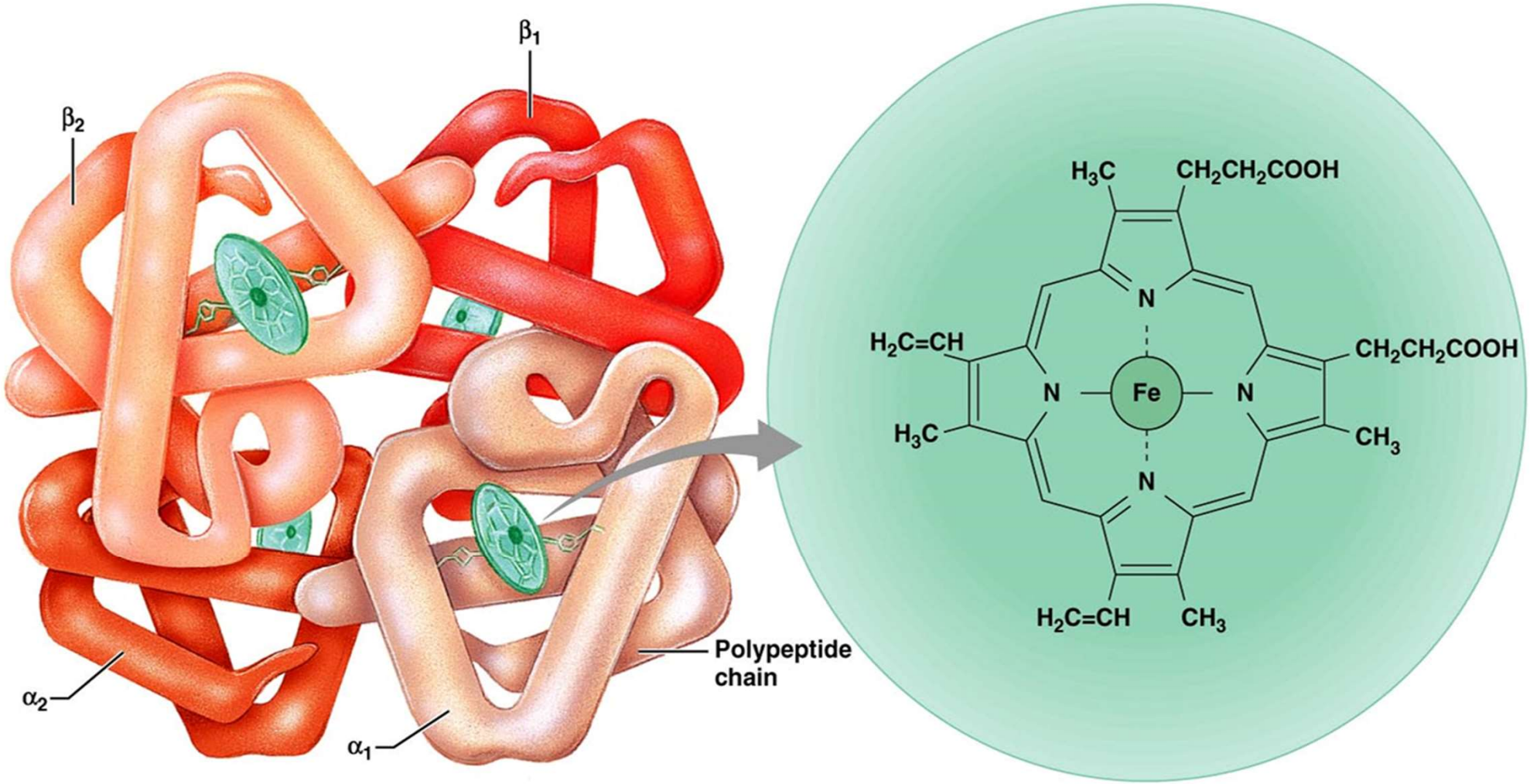
Red Marrow biopsy

Blue because of the stain Prussian blue staining iron in the bone marrow.

What this molecule represents and what are the names of the hiding blue ?







(a) Hemoglobin

(b) Iron-containing heme group

-

What factors Stimulate red blood cell Production?

What is the common denominator for all of these factors?

-

What factors Stimulate red blood cell Production?

1. Hemorrhage
2. Damage to bone marrow
3. Exposure to high altitude
4. Exercise
5. Hemolytic disease
6. Low hemoglobin levels

What is the common denominator for all of these factors?

Blood hypoxia due to a reduced oxygen-carrying capacity.

What are the physical characteristics of blood in terms of…

- Viscosity
- Temperature
- pH
- Salinity
- Volume

What are the physical characteristics of blood in terms of…

- Viscosity → 3.2×10^{-3} Pa-s (at 37° C)
- Temperature → 38º C or 100.4º F
- pH → 7.35 – 7.45
- Salinity → 85% – 90%
- Volume → 5-6L males, 4-5L females

Blood is thicker than water

What Comprises Blood Plasma?

What Comprises Blood Plasma?

- Water (%)
  - *90%*
- Proteins (5)
  - *albumin, fibrinogen, alpha-, beta-, gammaglobulin*
- Electrolytes (8)
  - *sodium, potassium, calcium, magnesium, chloride, phosphate, sulfate, bicarbonate*
- Nutrients (4)
  - *glucose, amino acids, lipids, vitamins*
- Respiratory gases (2)
  - *oxygen, carbon dioxide*
- Hormones (2)
  - *steroid, thyroid*
- Metabolic wastes (5)
  - *urea, lactic acid, creatinine, uric acid, ammonium salts*

What are the functions of blood?

What are the functions of blood?

Primary

- Transportation
  - Nutrients
  - Metabolic waste
  - Hormones
- Exchange of gases
  - Oxygen
  - Carbon dioxide

Secondary

- Immunity
- Thermoregulation
- Fluid volume balance
- pH balance

Match these definitions:

Hematopoiesis
Hemocytoblast
Hematocrit
Hemolysis
Hemorrhage
Hematoma
Heme
Hemostasis
Hemosiderin
Hemoglobin

A. The volume of total blood volume occupied by erythrocytes
B. Development and production of blood cells
C. Blood stem cell
D. Rupture of erythrocytes
E. Iron-containing essential to oxygen transport by hemoglobin
F. Mass of clotted blood that forms at an injured site
G. The stoppage of bleeding
H. Erythrocytes outside of the endothelium
I. Storage protein for iron
J. Oxygen-transporting proteins of erythrocytes

Match these definitions:

Hematopoiesis	A. The volume of total blood volume occupied by erythrocytes
Hemocytoblast	B. Development and production of blood cells
Hematocrit	C. Blood stem cell
Hemolysis	D. Rupture of erythrocytes
Hemorrhage	E. Iron-containing essential to oxygen transport by hemoglobin
Hematoma	F. Mass of clotted blood that forms at an injured site
Heme	G. The stoppage of bleeding
Hemostasis	H. Erythrocytes outside of the endothelium
Hemosiderin	I. Storage protein for iron
Hemoglobin	J. Oxygen-transporting proteins of erythrocytes

SOME CHALLENGING SLIDES

White Blood Cell Type	Differential Count	Normal Value
Neutrophil	61%	60–75%
Lymphocyte	%	20–30%
Monocyte	%	3–8%
Eosinophil	%	1–3%
Basophil	%	0–1%

White Blood Cell Type	Number	Percentage
Neutrophil	183	
Lymphocyte		
Monocyte	21	
Eosinophil		3
Basophil		1
Total	**300**	**100**

Neutrophil: 183–61%

Lymphocyte: 84–28%

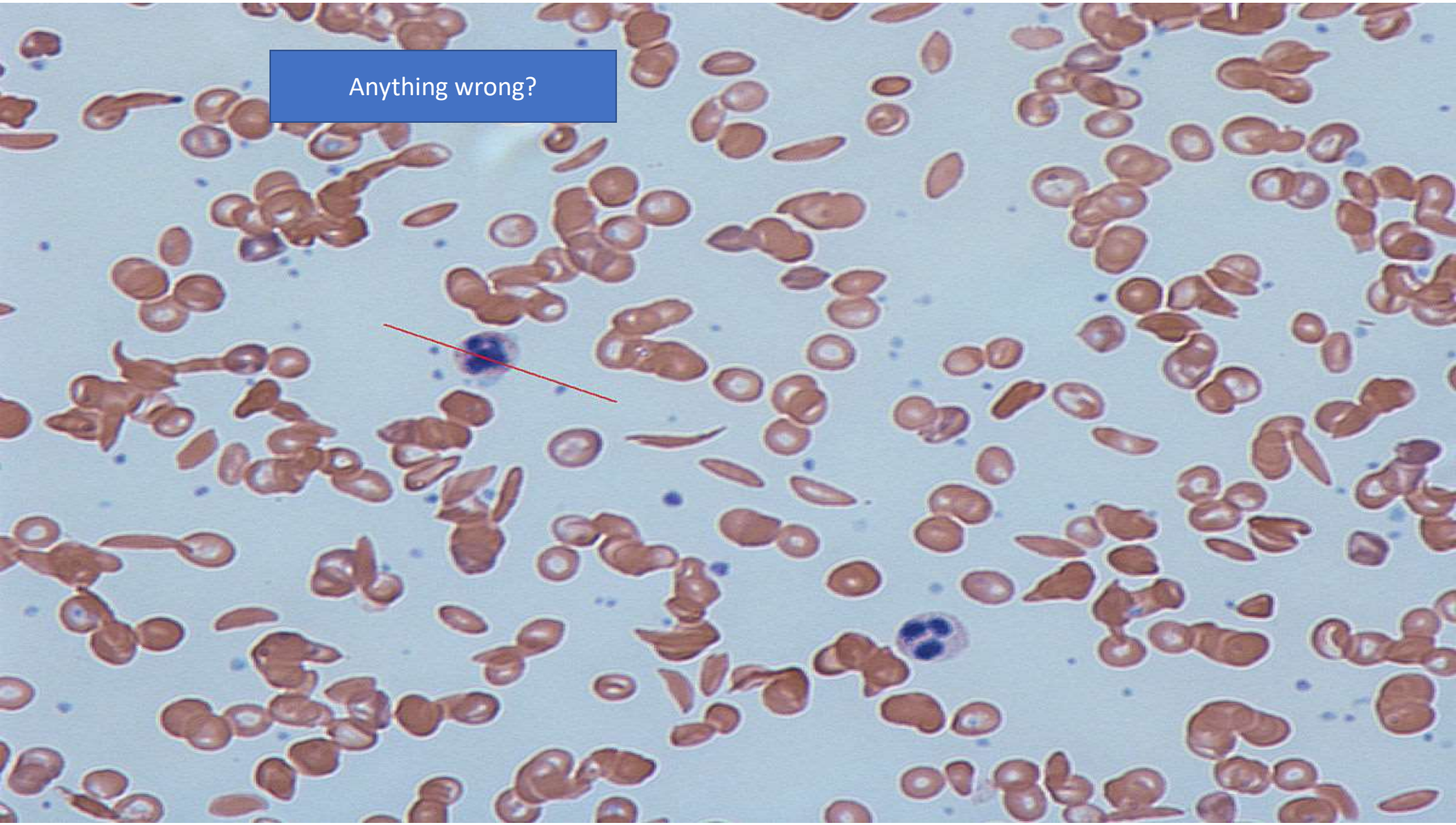
Monocyte: 21–7%

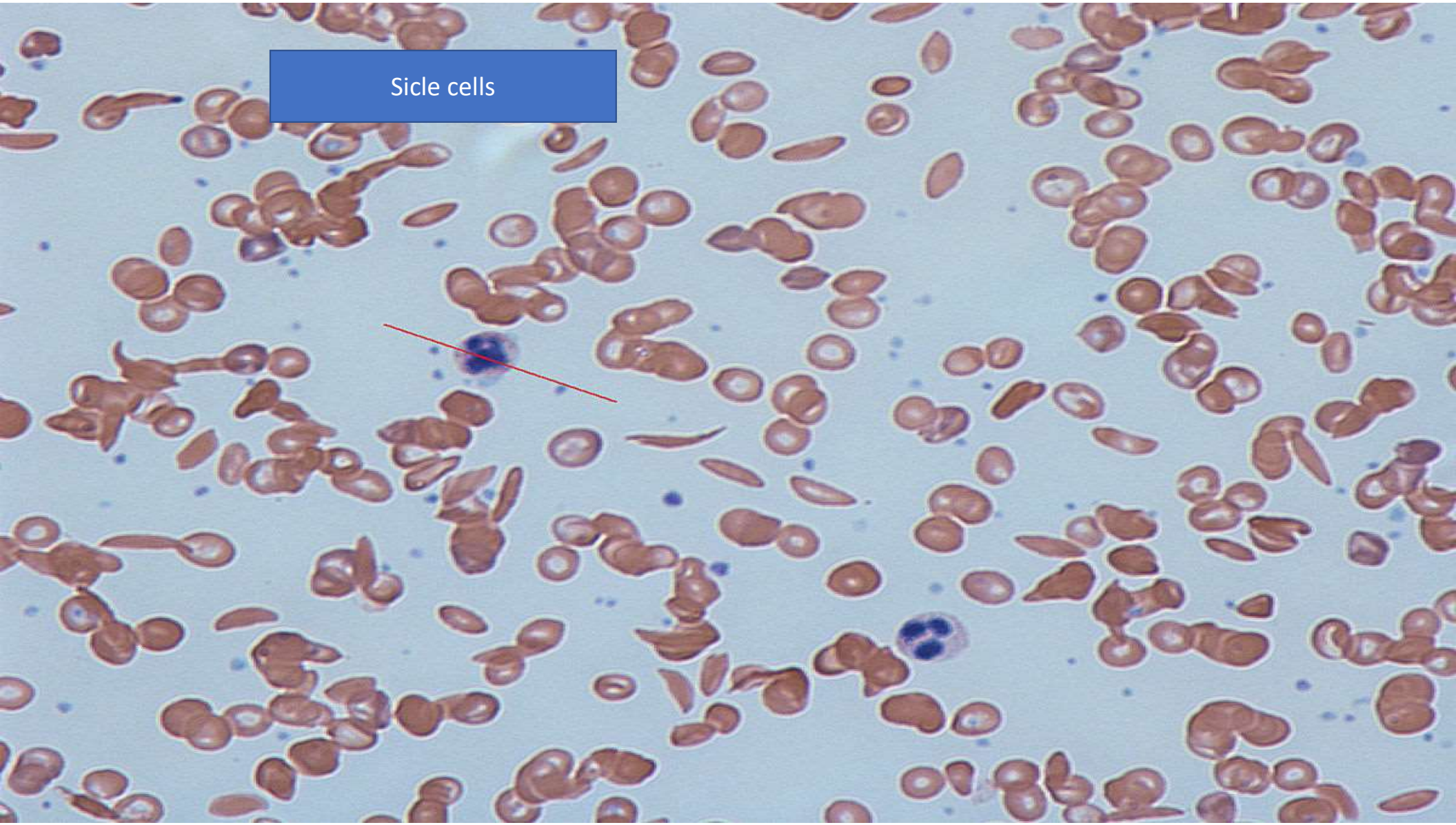
Eosinophil: 9–3%

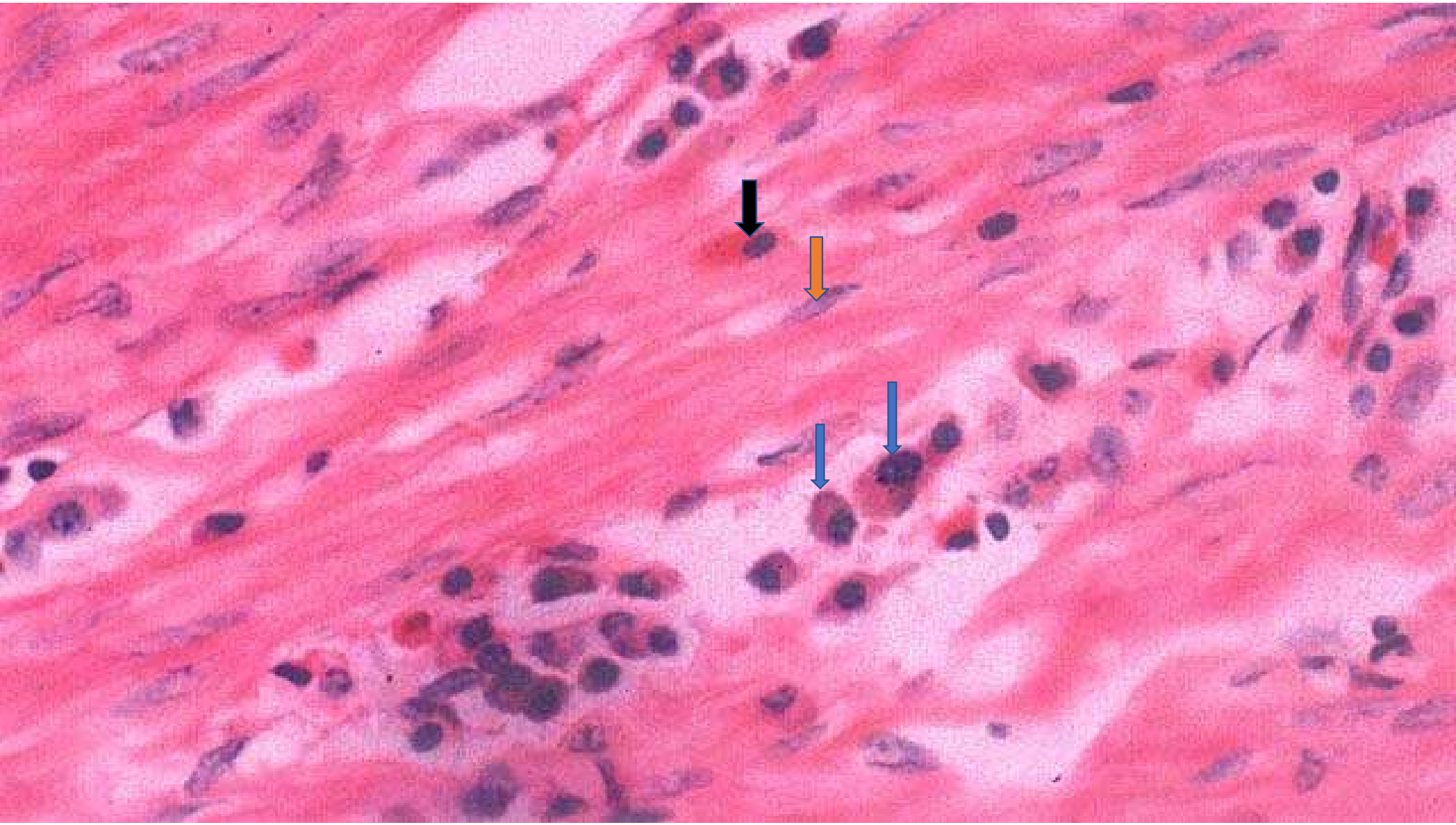
Basophil: 3–1%

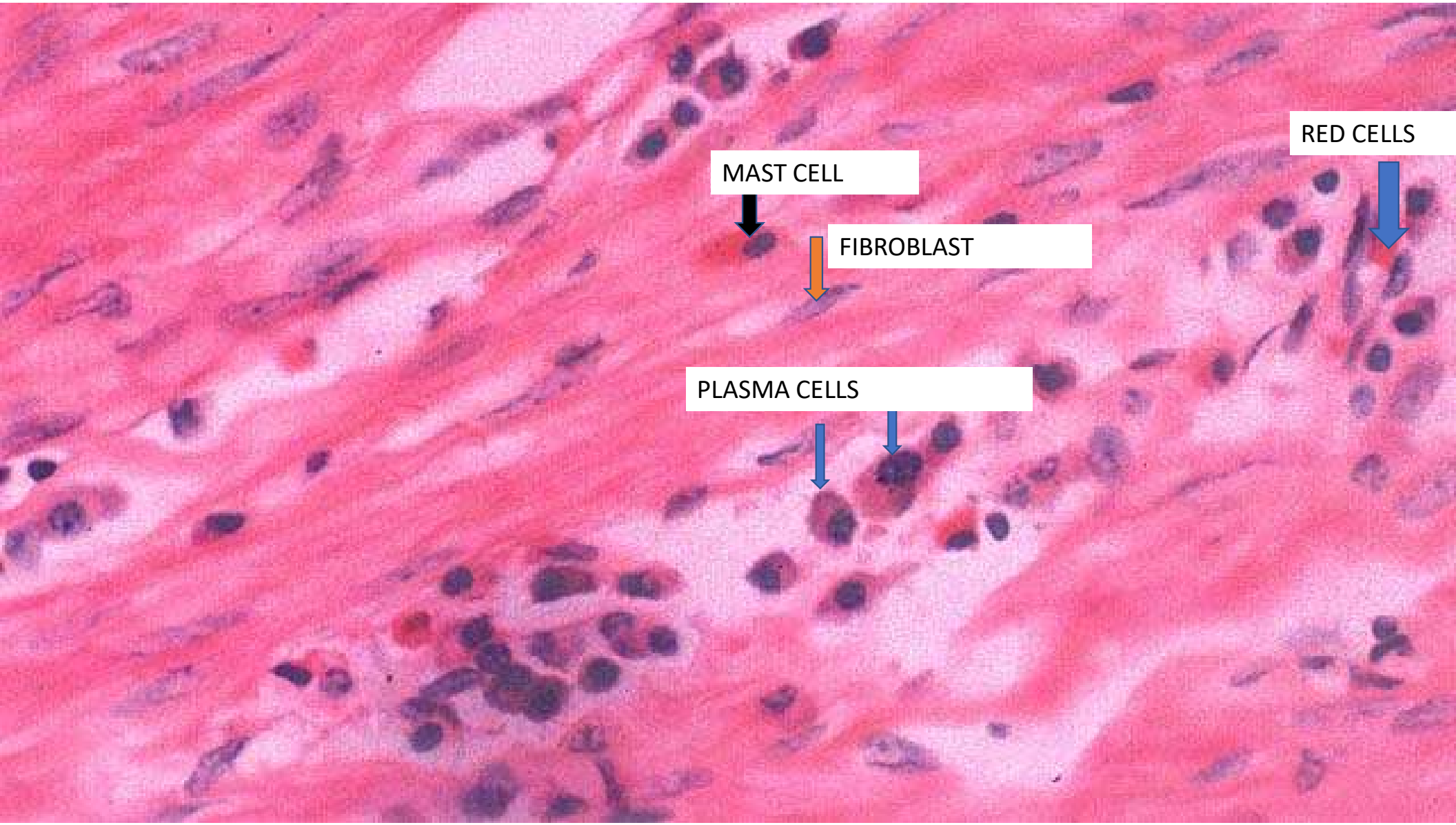
5/ what is going on with this baby?

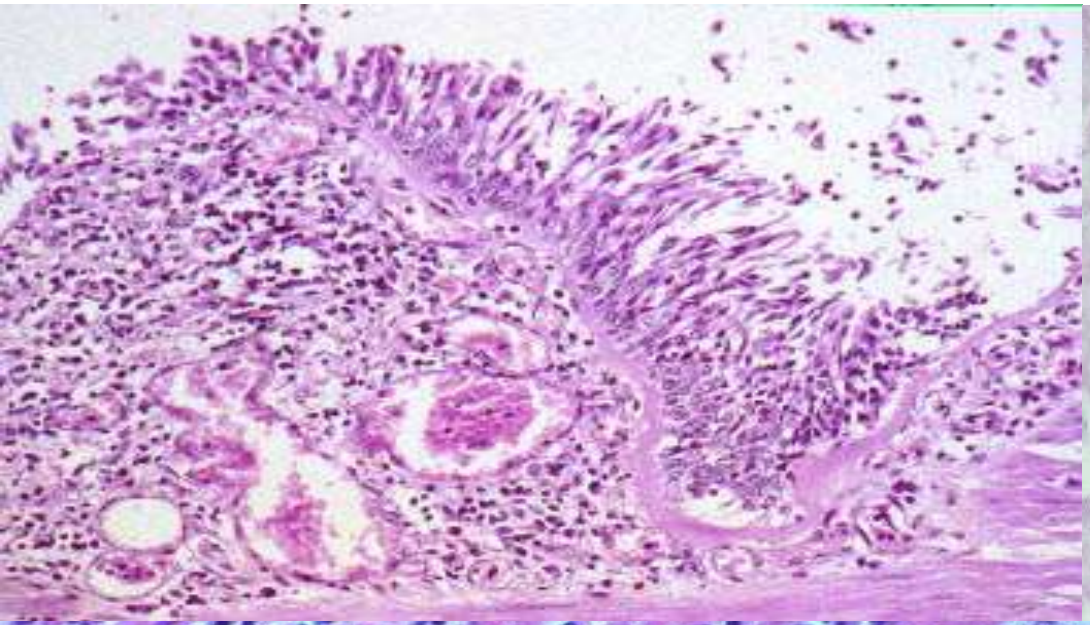
5/ what is going on with this baby? Erythroblastosis fetalis = mother rhesus incompatibility

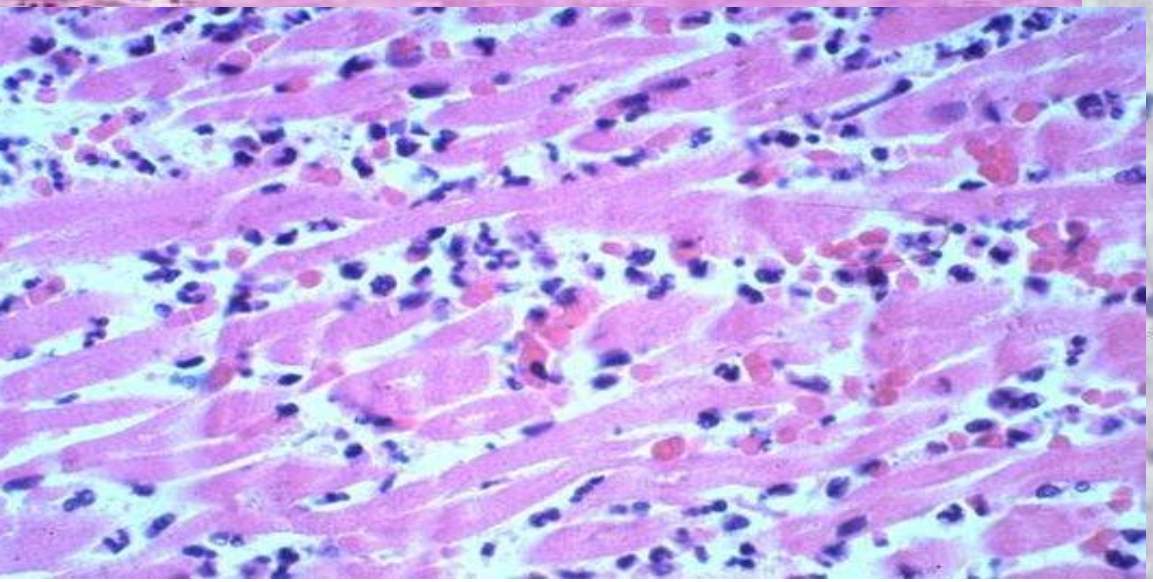

Anything wrong?

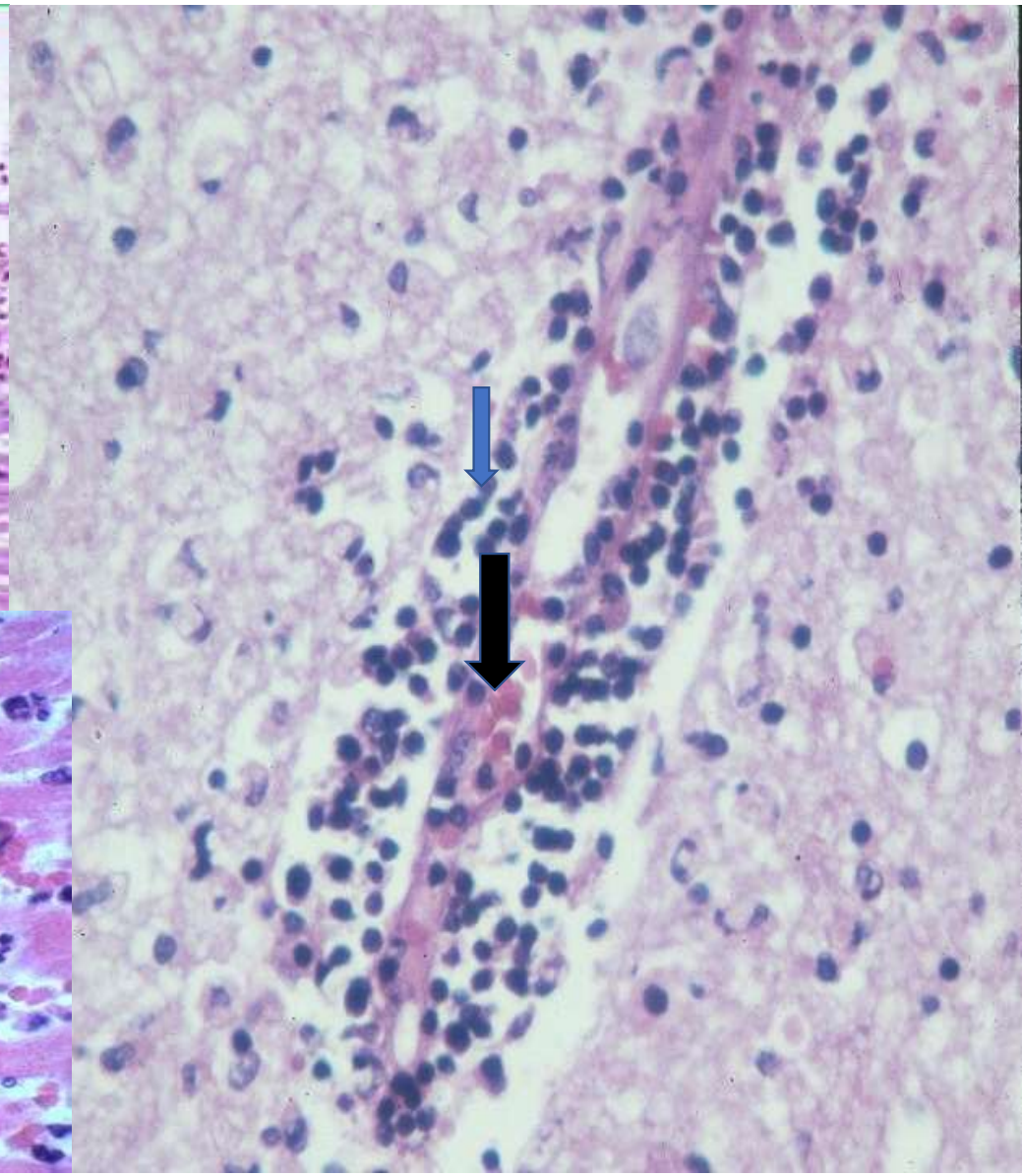

Sicle cells

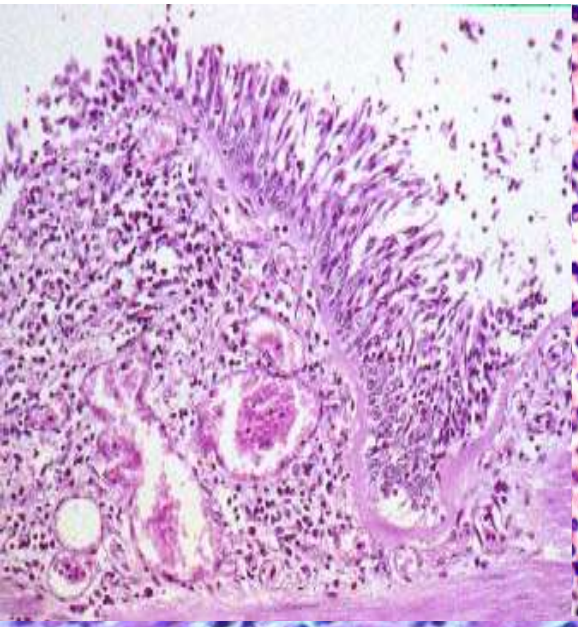


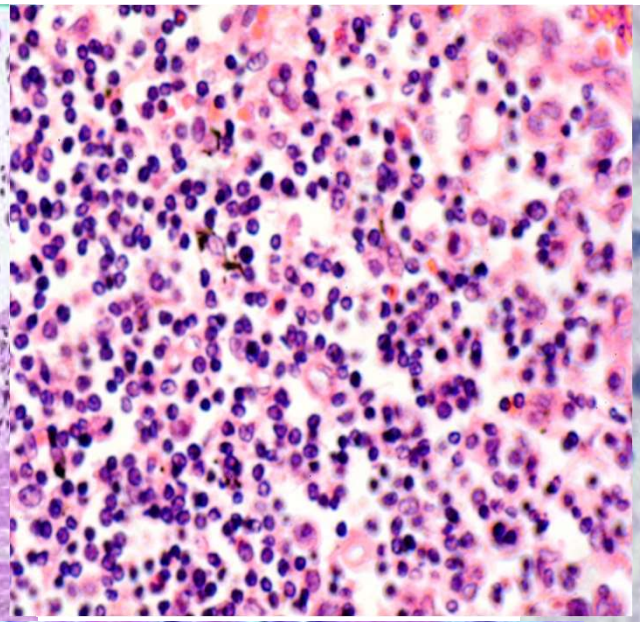

MAST CELL
FIBROBLAST
PLASMA CELLS
RED CELLS

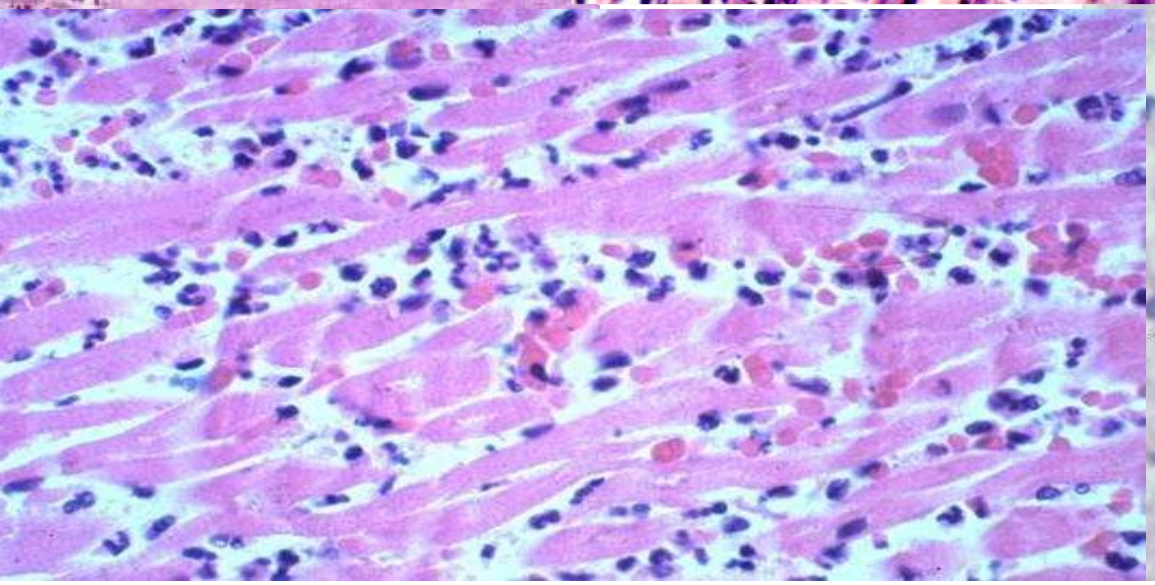


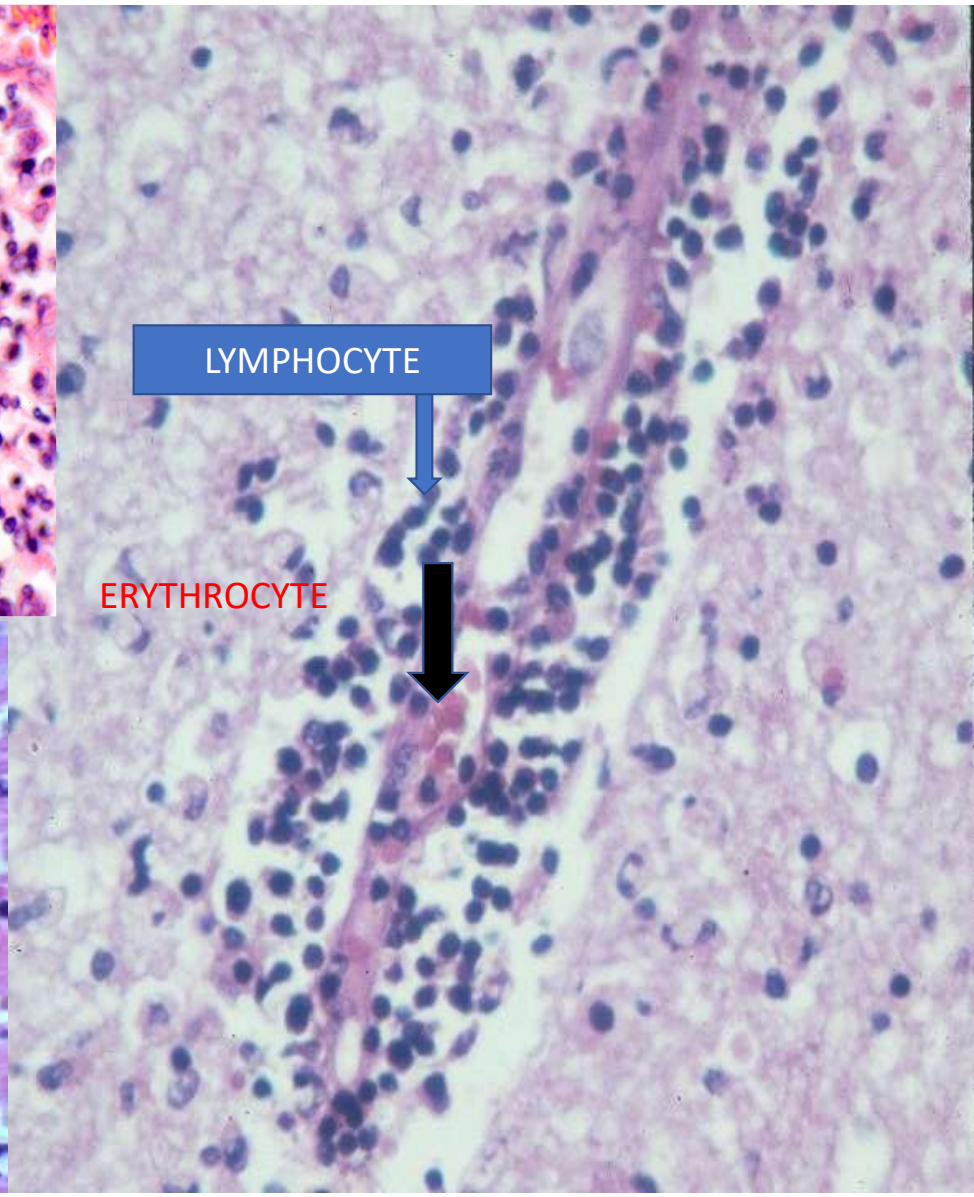


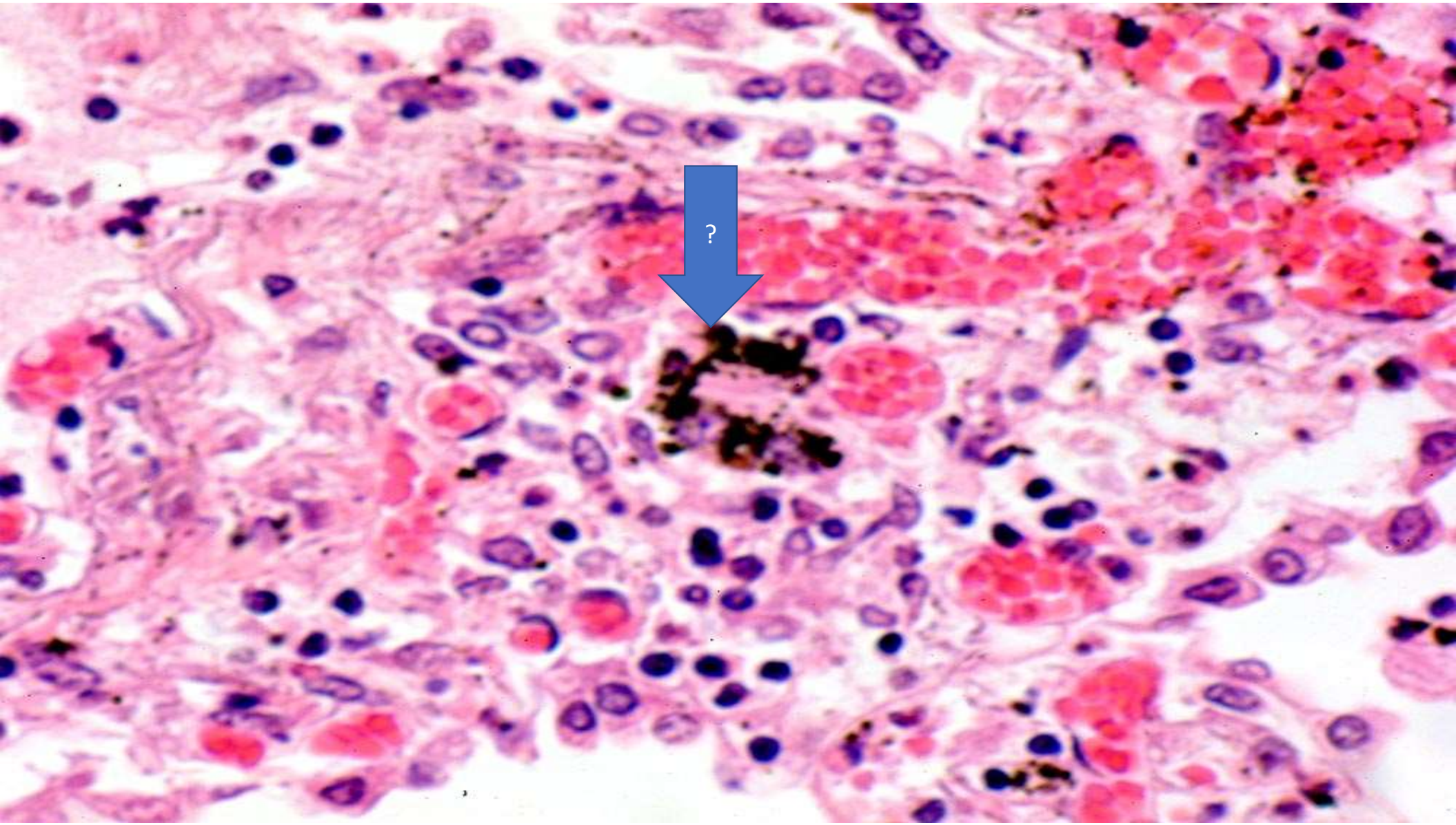


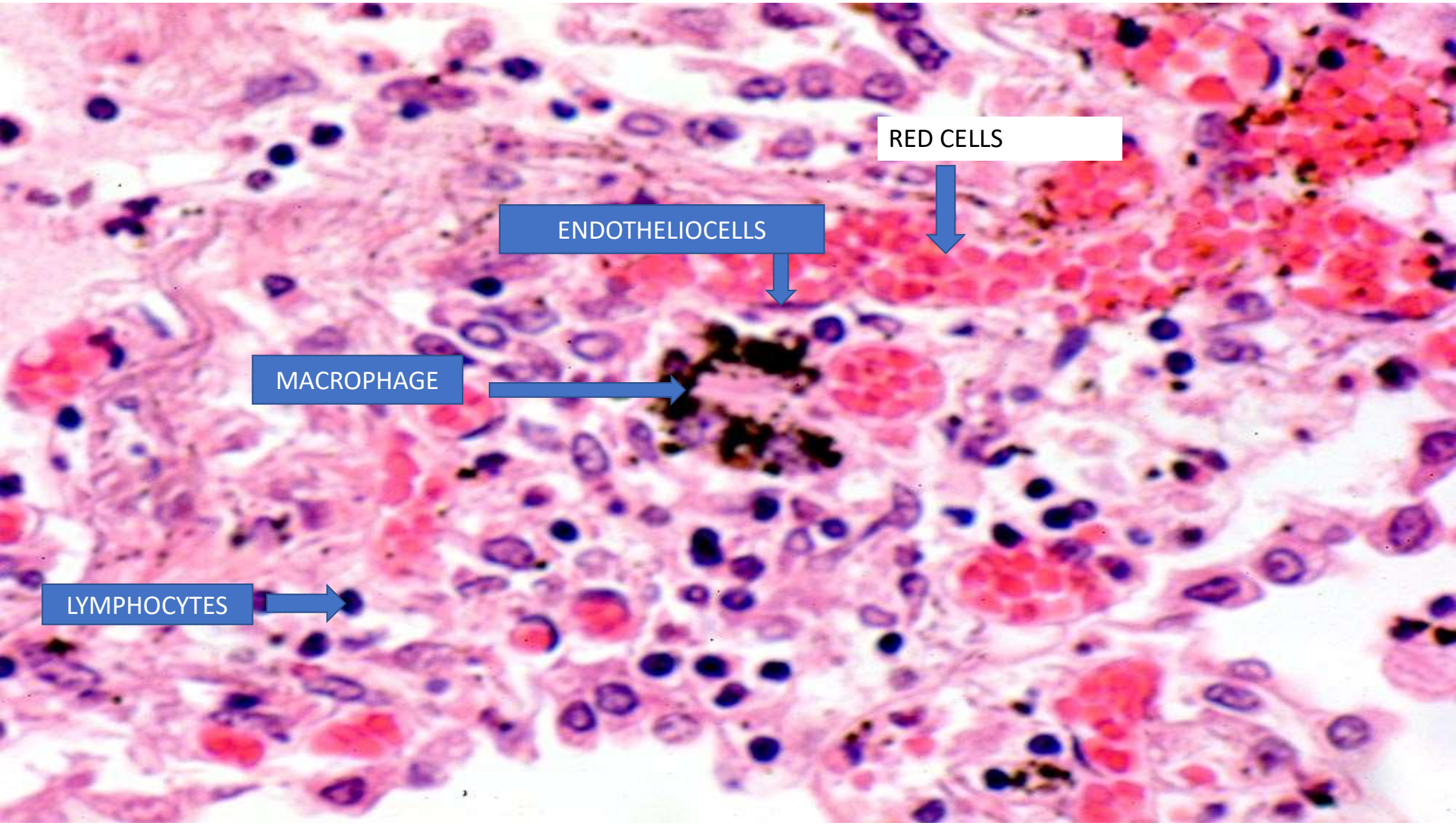


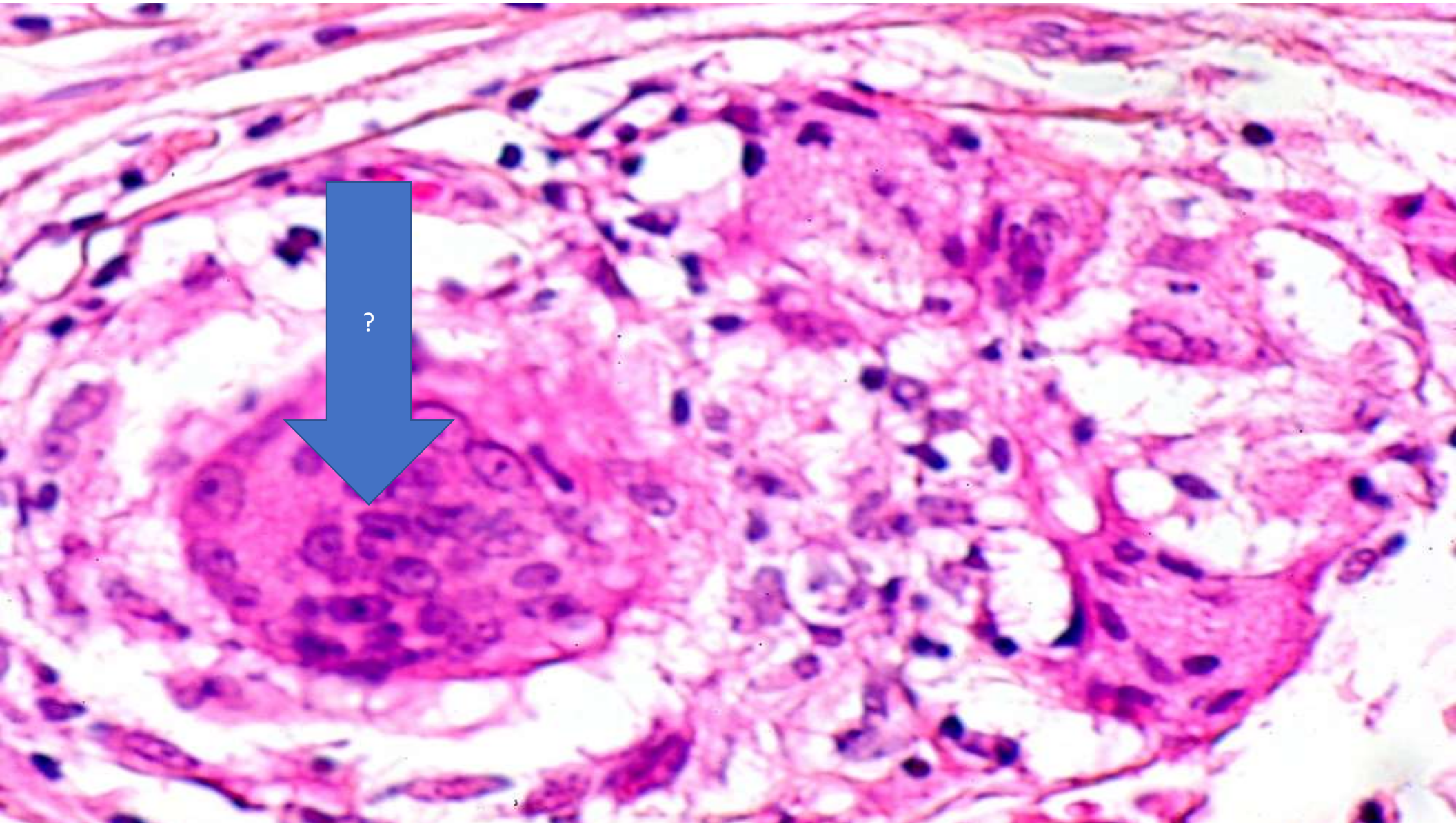


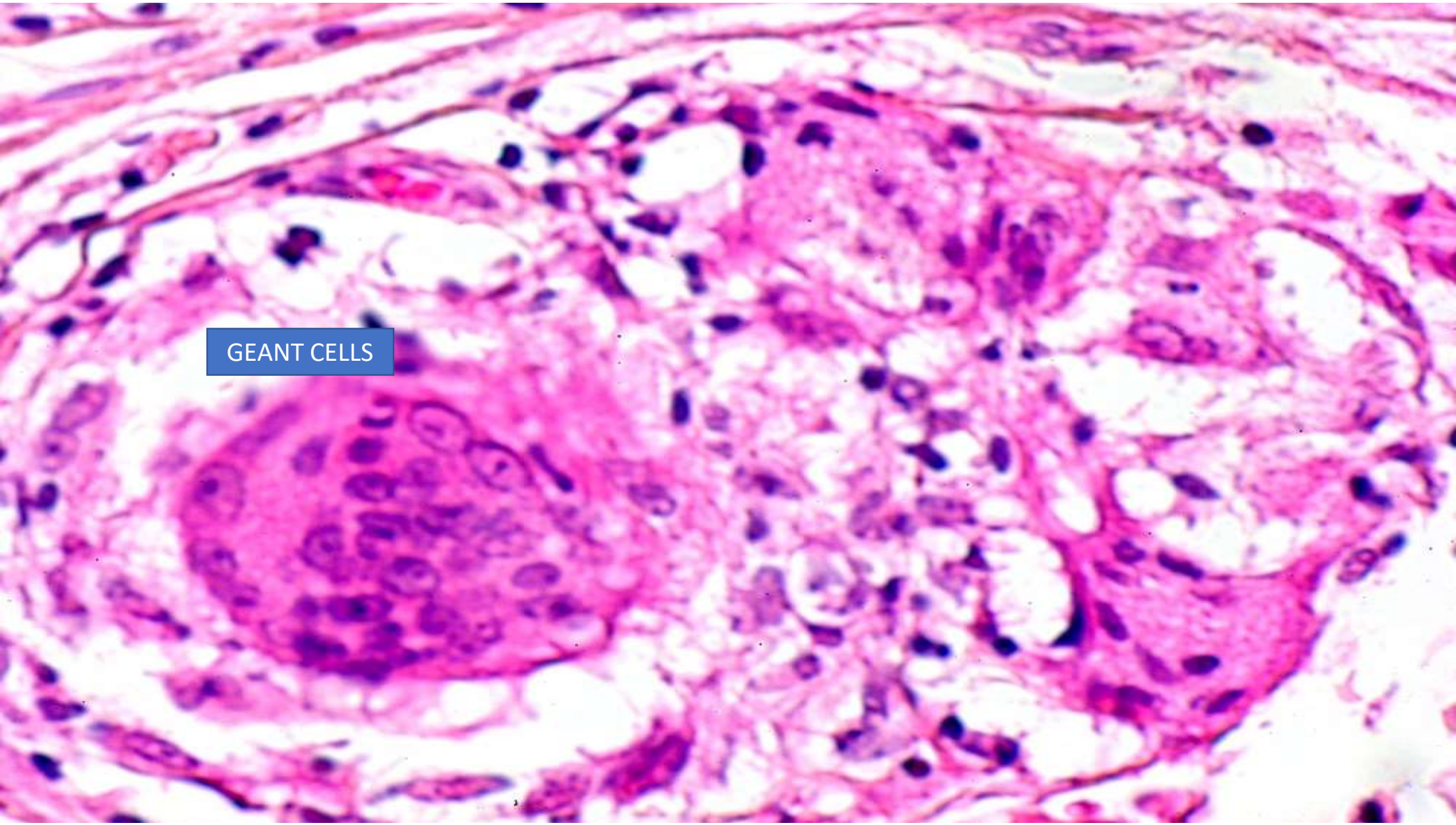


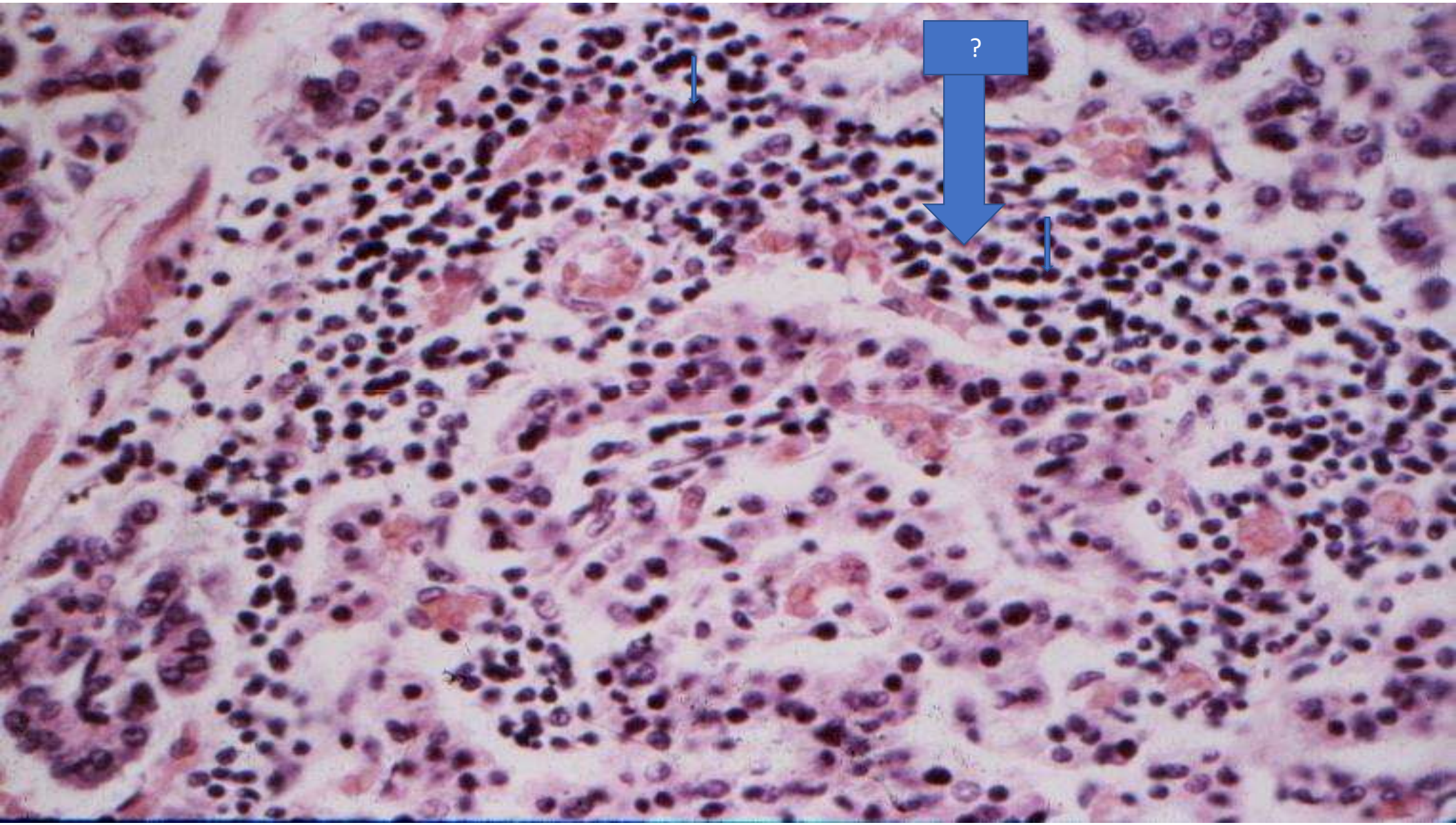

LYMPHOCYTE
ERYTHROCYTE

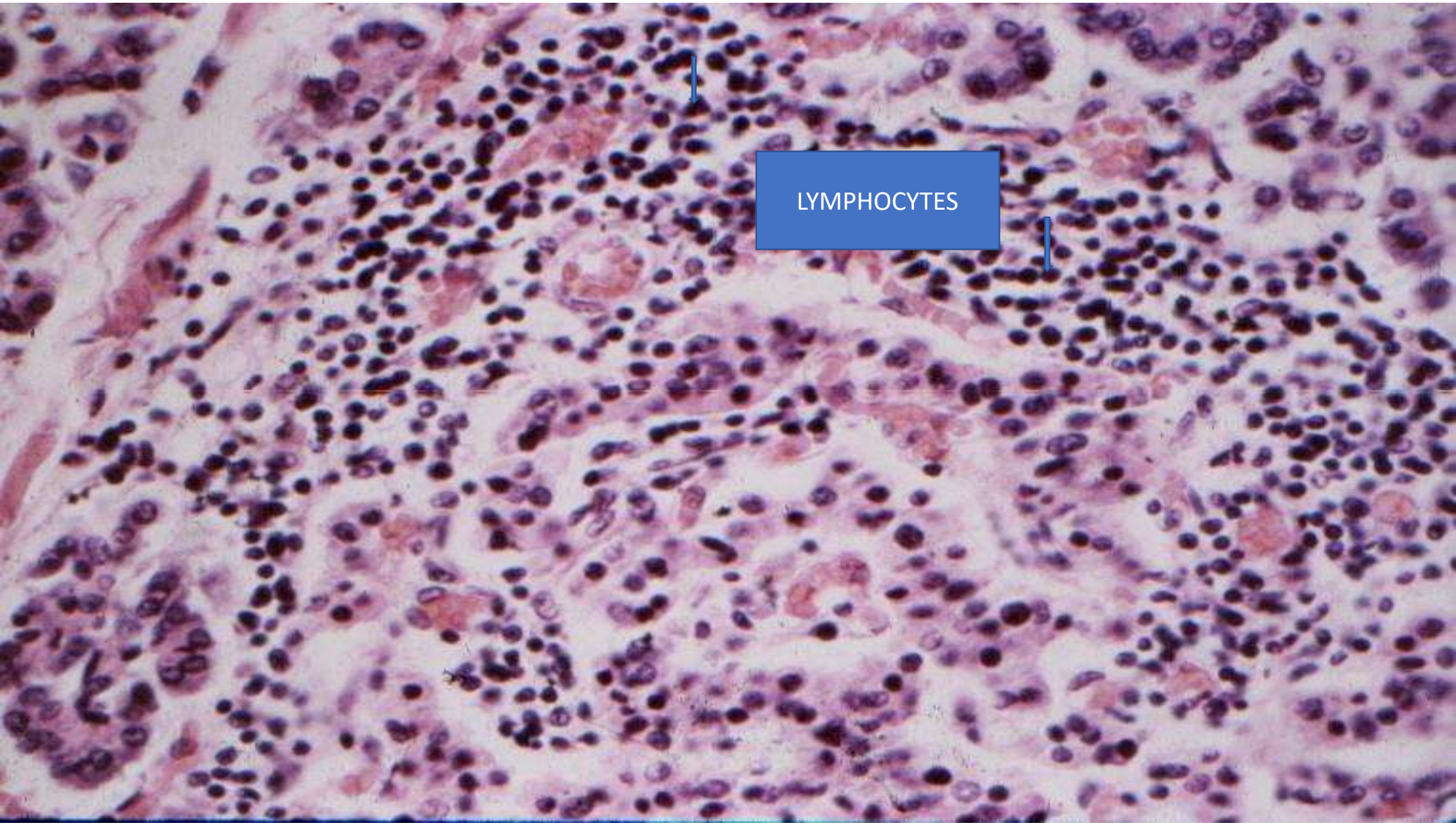


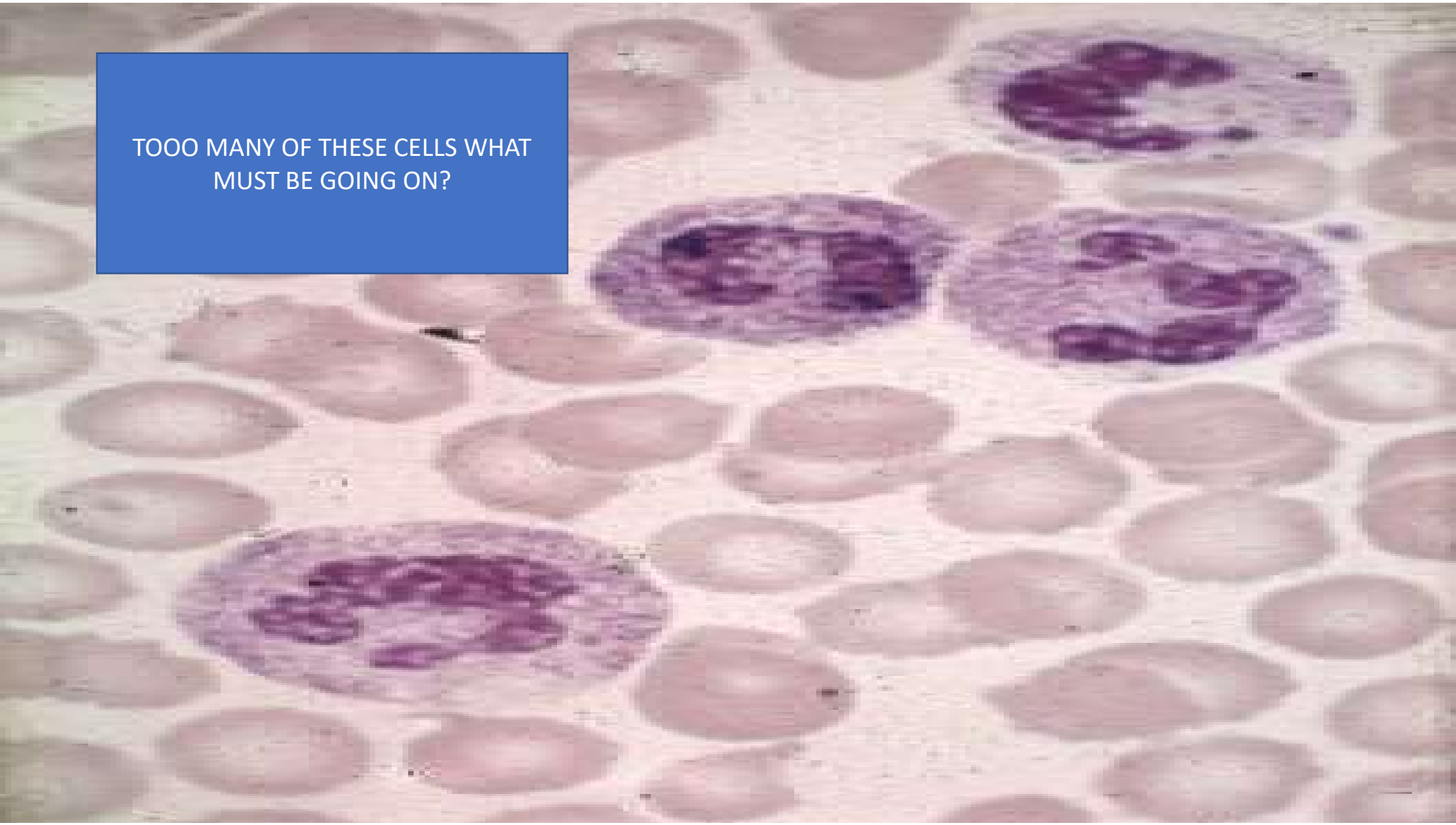

RED CELLS
ENDOTHELIOCELLS
MACROPHAGE
LYMPHOCYTES

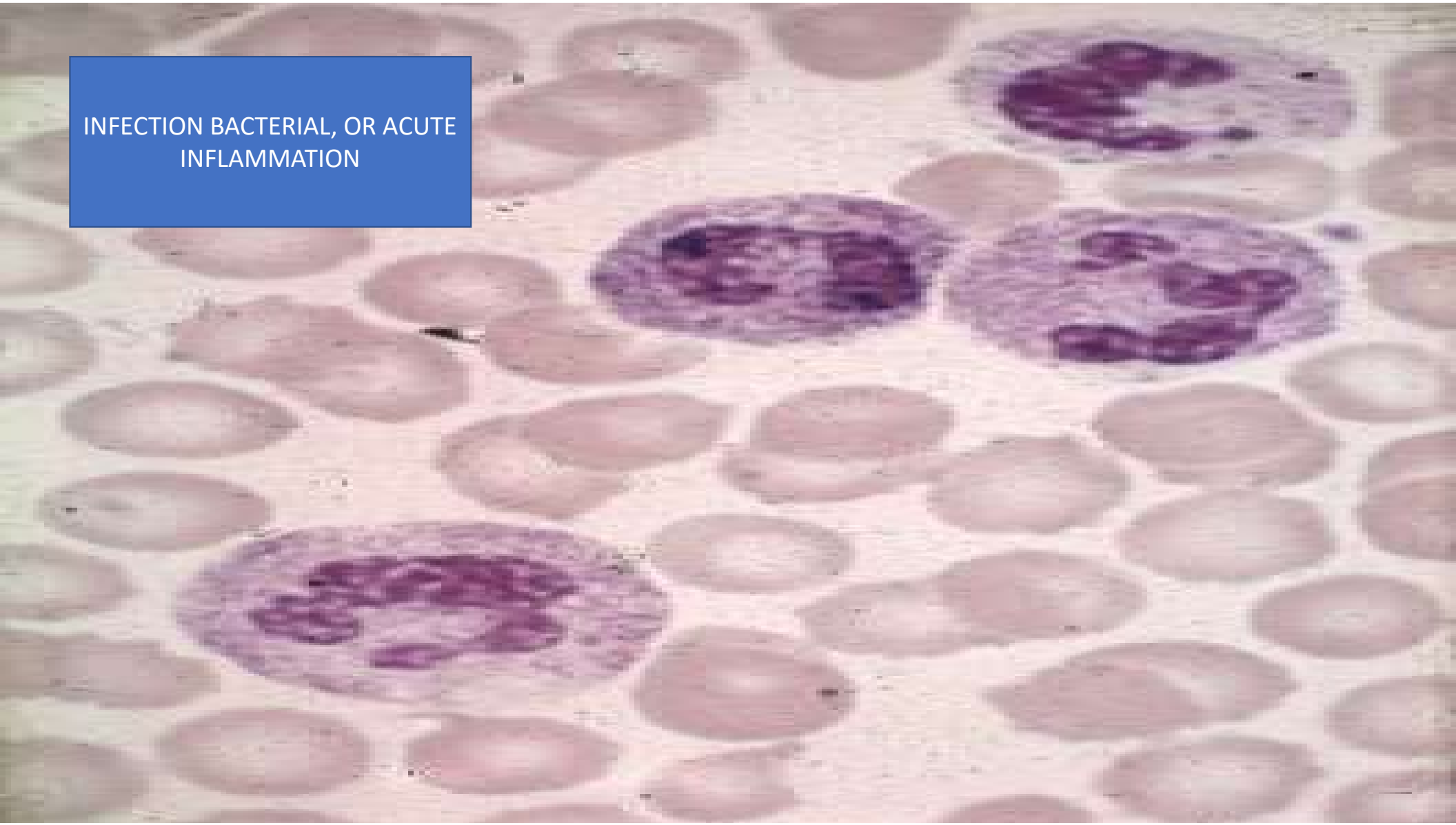


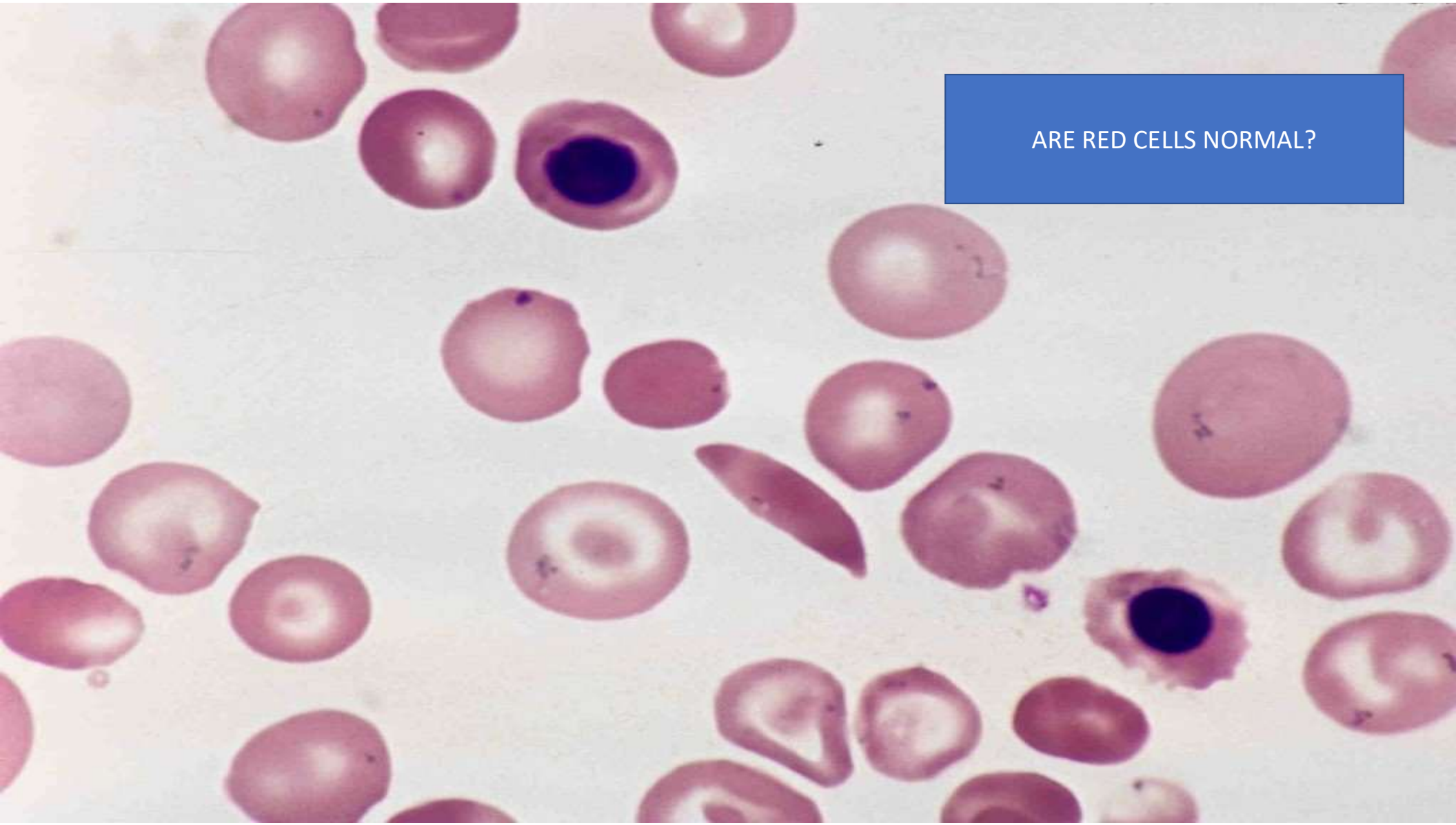

GEANT CELLS

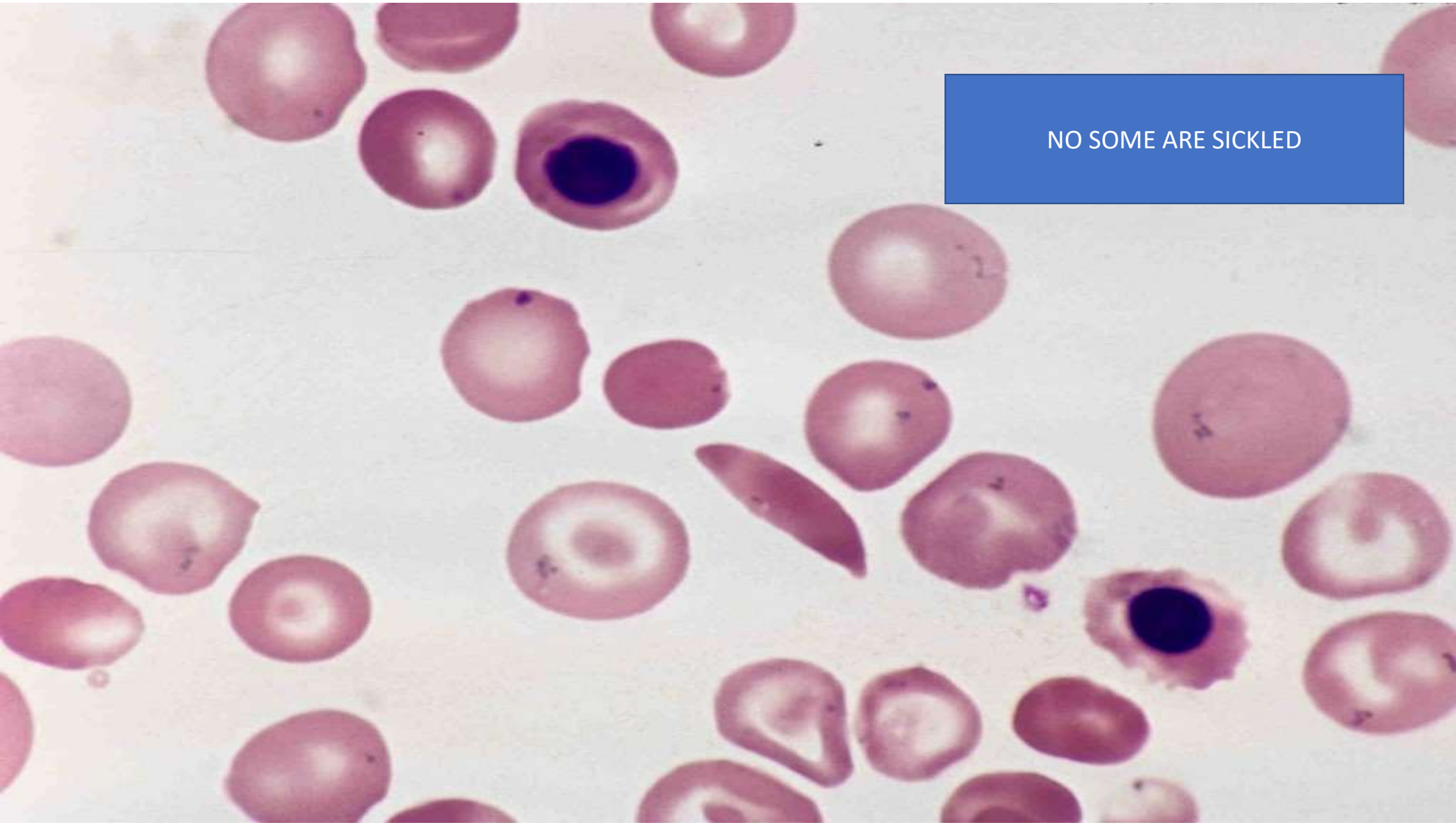


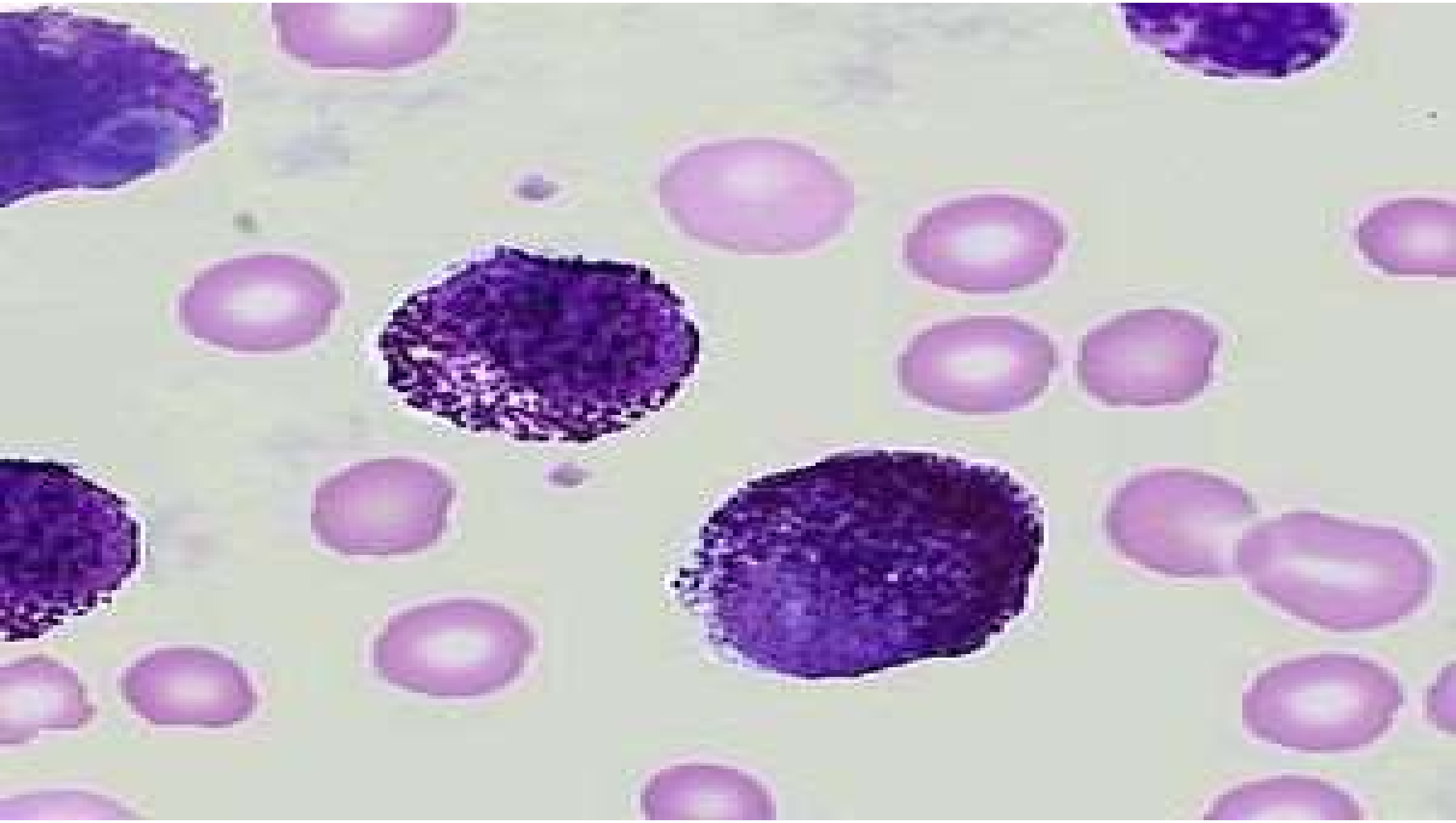

LYMPHOCYTES


TOOO MANY OF THESE CELLS WHAT MUST BE GOING ON?

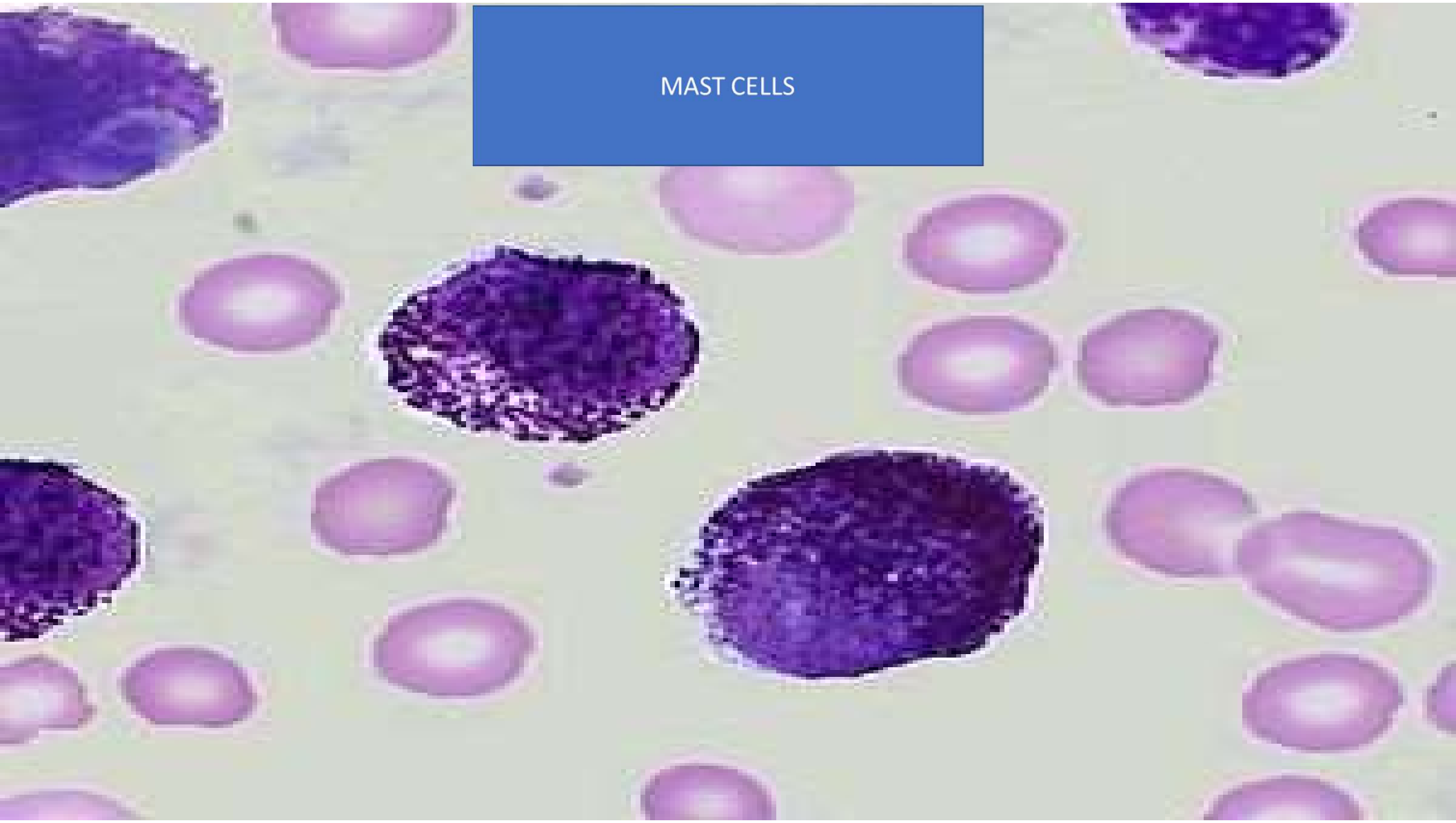

INFECTION BACTERIAL, OR ACUTE INFLAMMATION


ARE RED CELLS NORMAL?


NO SOME ARE SICKLED



MAST CELLS



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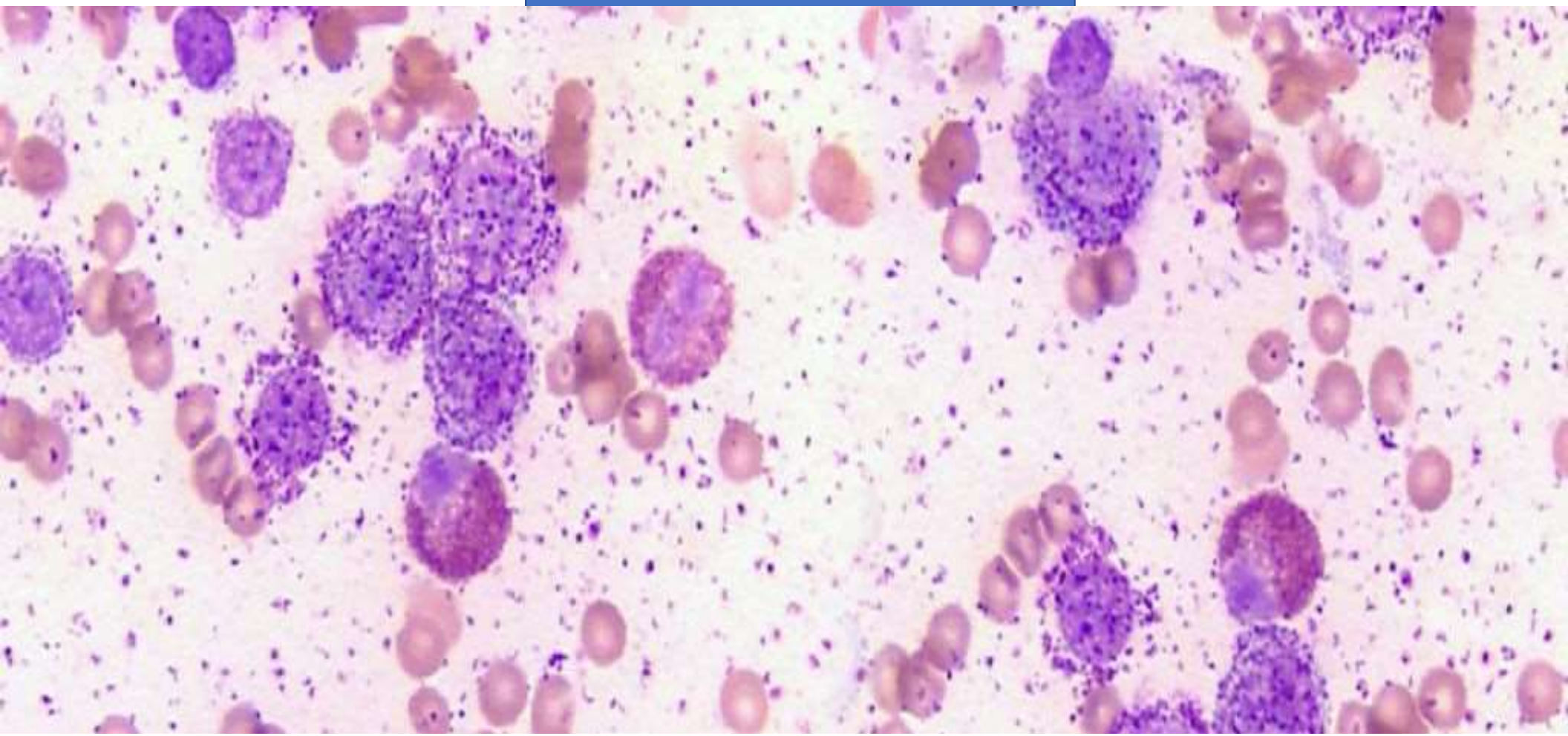
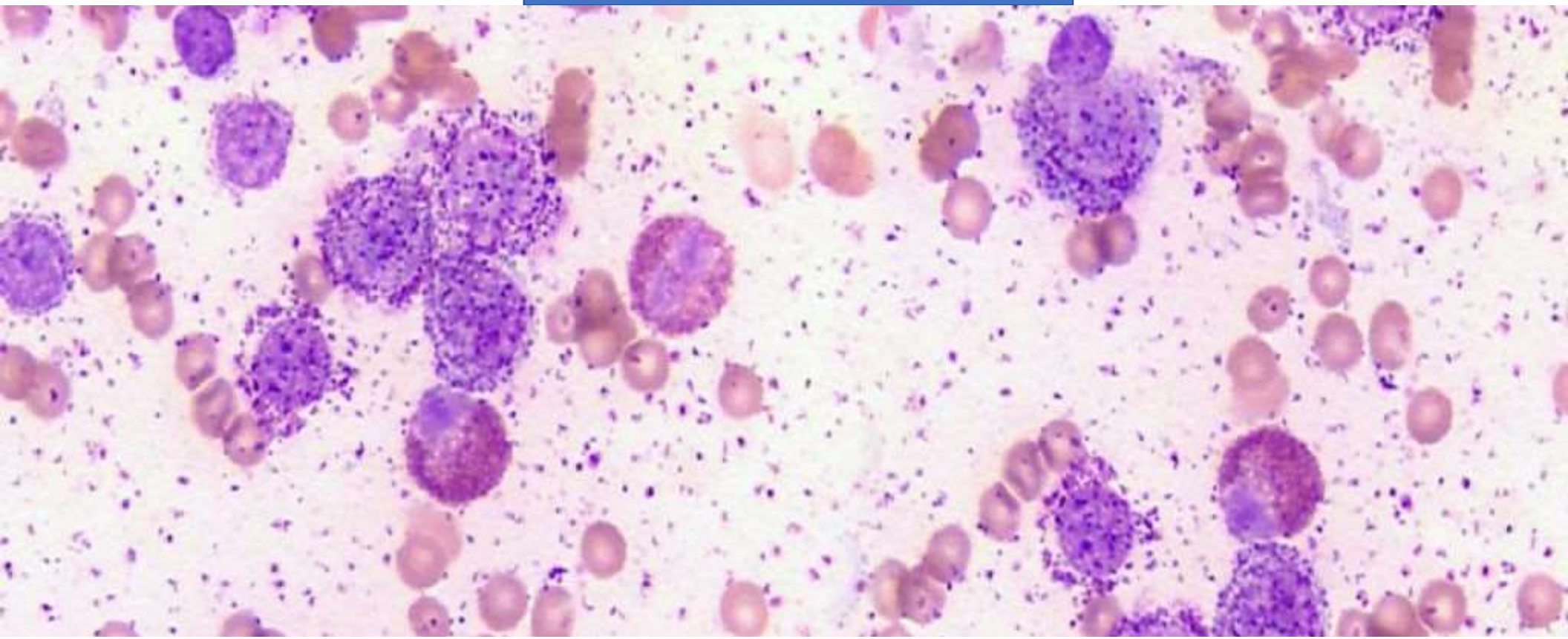
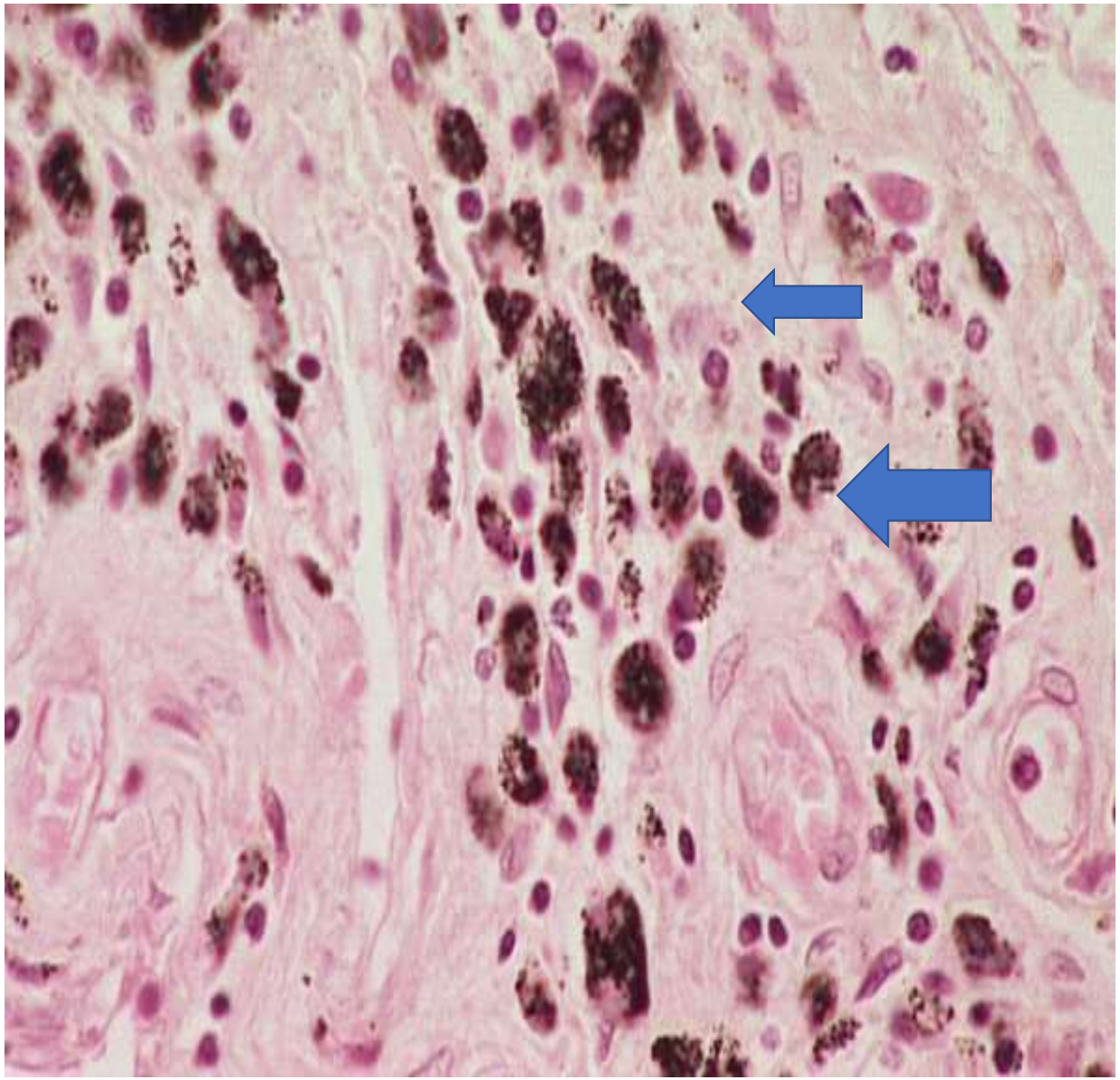


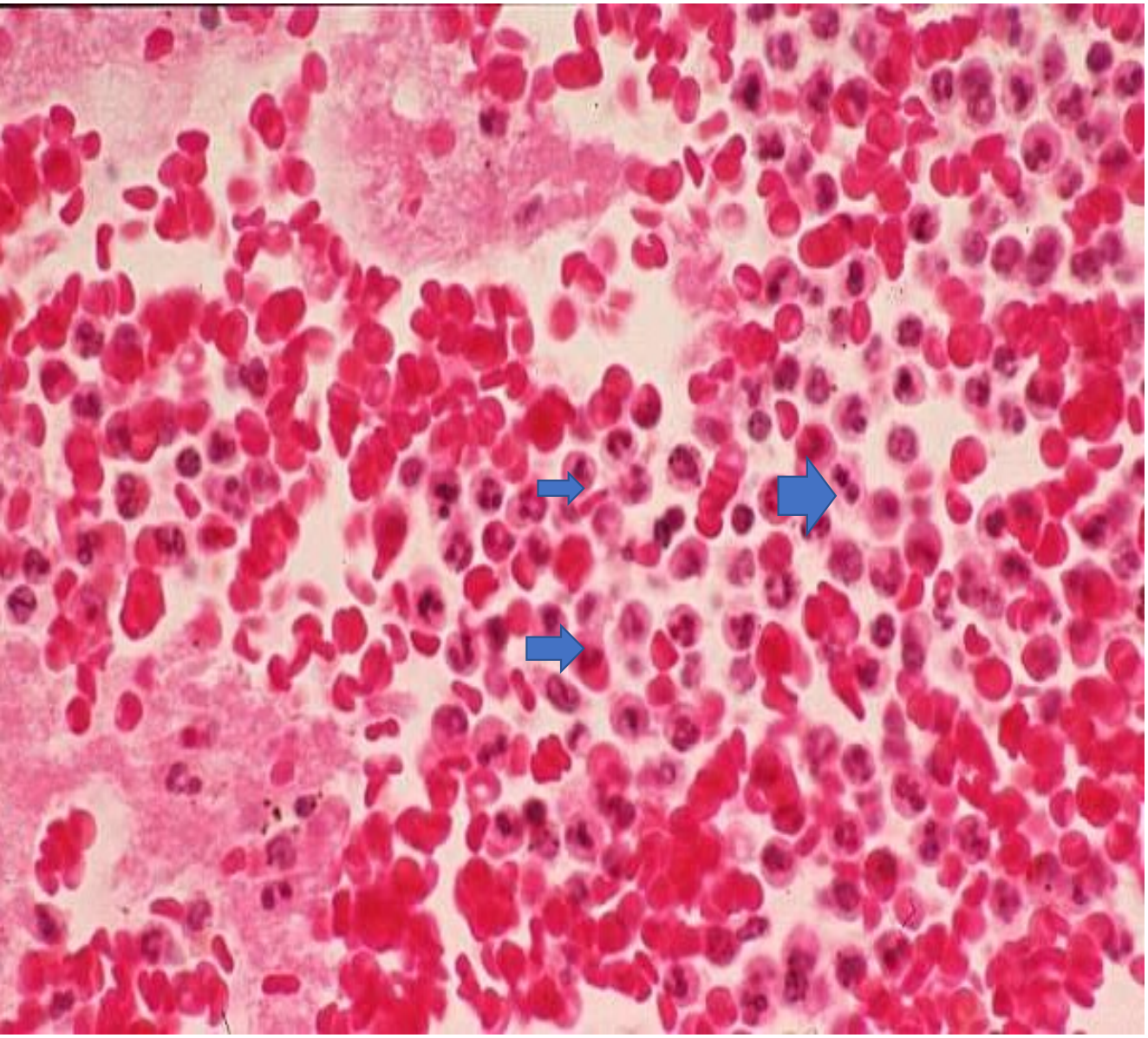
MAST CELLS





2/ IDENTIFY THESE CELLS [ARROW]

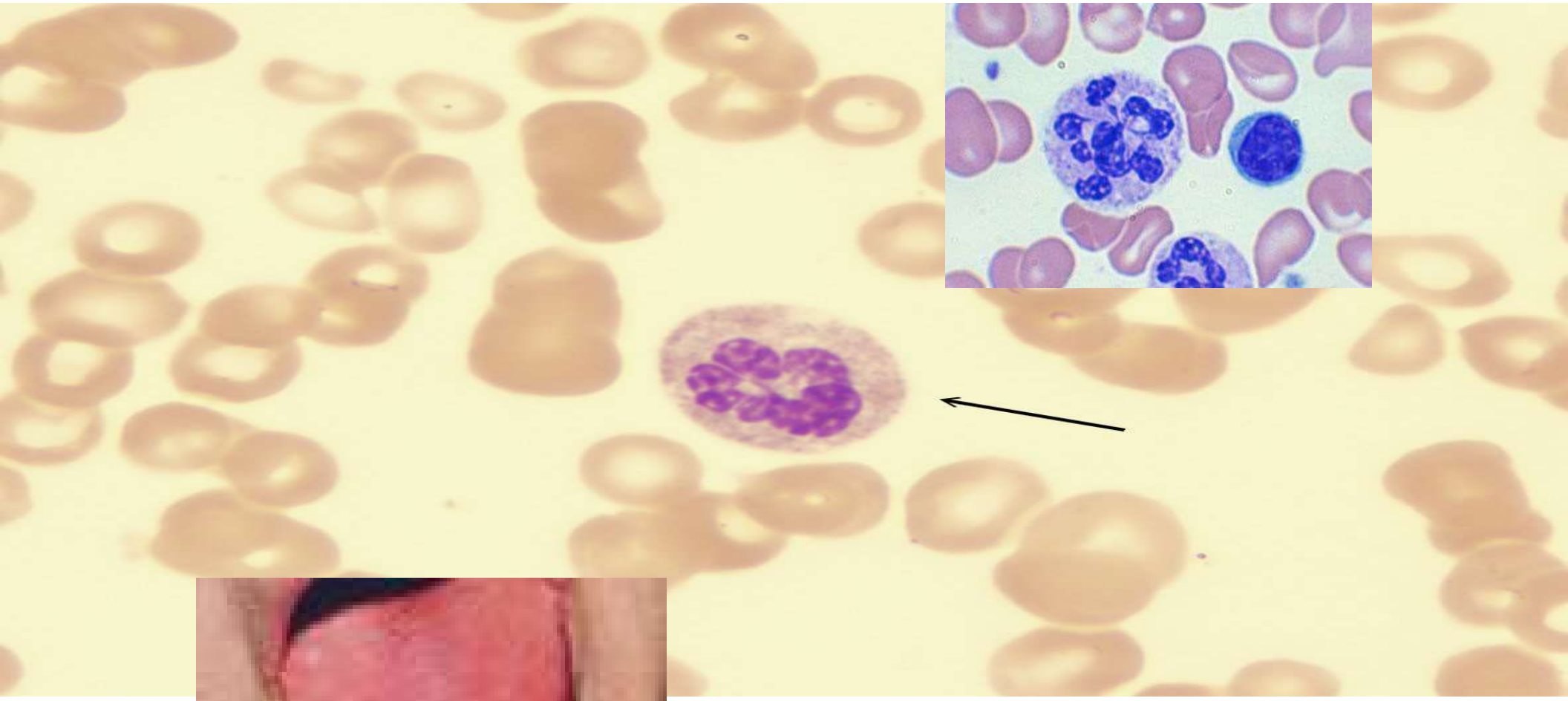
Dust cells in the lung



4/WHAT MIGHT BE GOING ON THIS SLIDE?

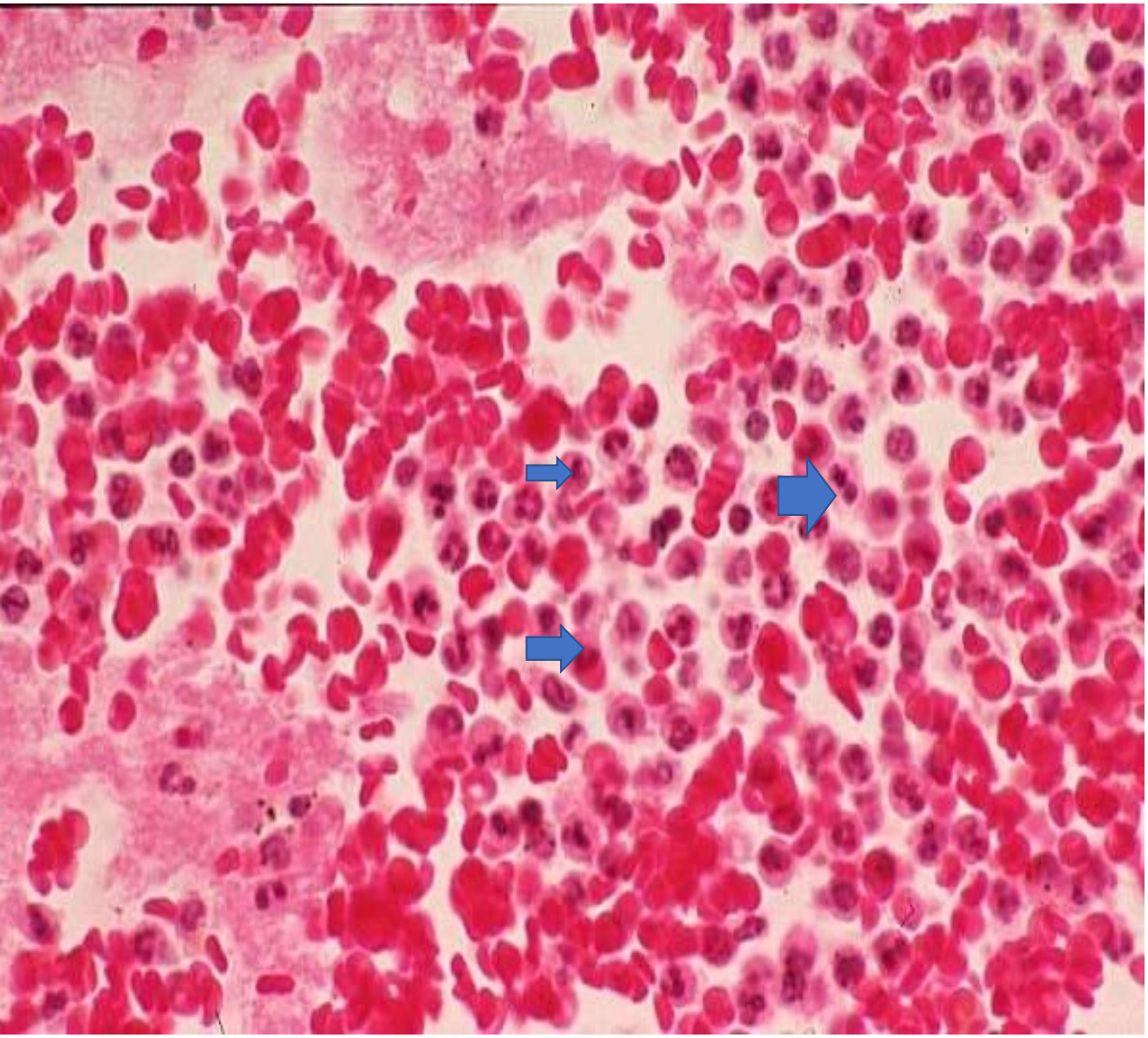
5/WHAT IS GOING ON WITH RED CELLS?

Hemorrhage, red cells outside blood vessels



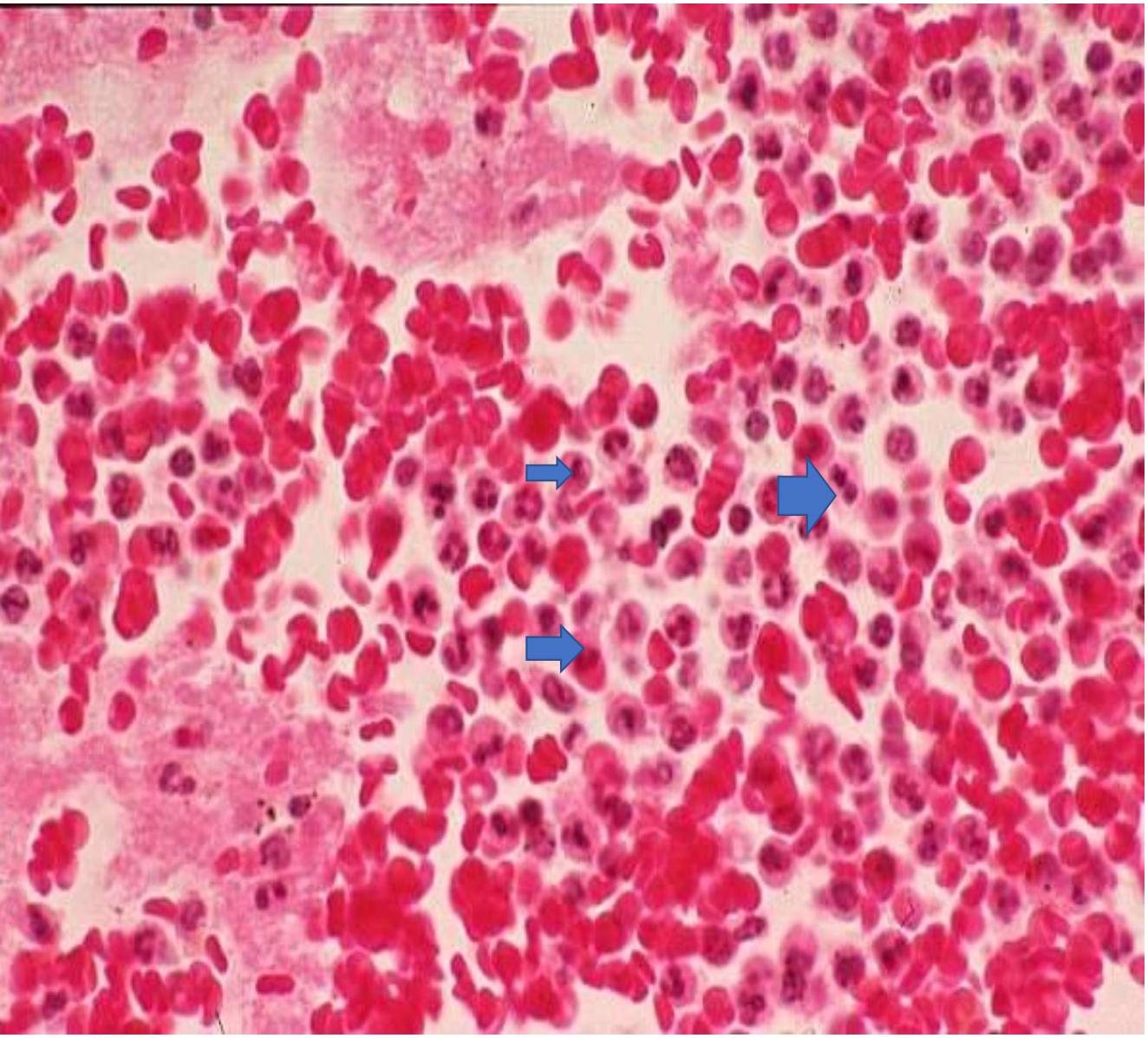
9/WHAT DO YOU THINK ABOUT THIS SLIDE

B 12 deficiency



4/WHAT MIGHT BE GOING ON THIS SLIDE?

5/WHAT IS GOING ON WITH RED CELLS?



4/WHAT MIGHT BE GOING ON THIS SLIDE?
Hemorrhage

5/WHAT IS GOING ON WITH RED CELLS?

Neutrophilia = acute inflammation, or bacterial infection