Lab 19 – Endocrine System

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Endocrine System

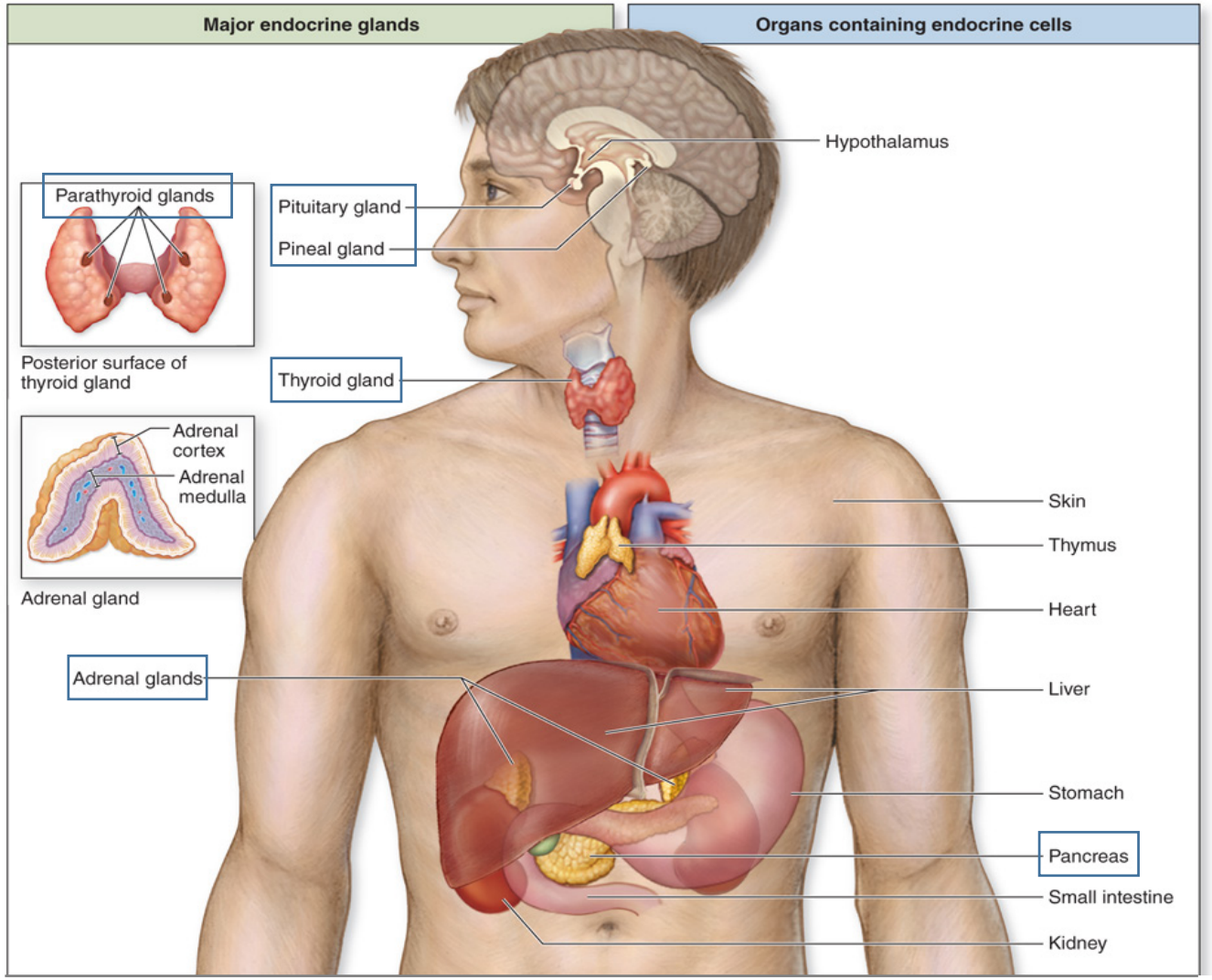

Fig 20-1, *Junqueira*, 13th ed.

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Keywords

Acidophils
Adrenal cortex
Adrenal gland
Adrenal medulla
Anterior pituitary
Basophils
Chromaffin cells
Chromophils
Chromophobes
Colloid
Corpora arenacea
Follicular cell
Herring body
Islets of Langerhans
Oxyphil cell
Pancreas
Parafollicular cell
Parathyroid gland
Pars distalis
Pars intermedia
Pars nervosa
Pineal gland
Pinealocytes
Pituicytes
Pituitary gland
Posterior pituitary
Principal (chief) cell
Rathke's pouch
Thyroid follicle
Thyroid gland
Venous sinuses
Zona fasciculata
Zona glomerulosa
Zona reticularis

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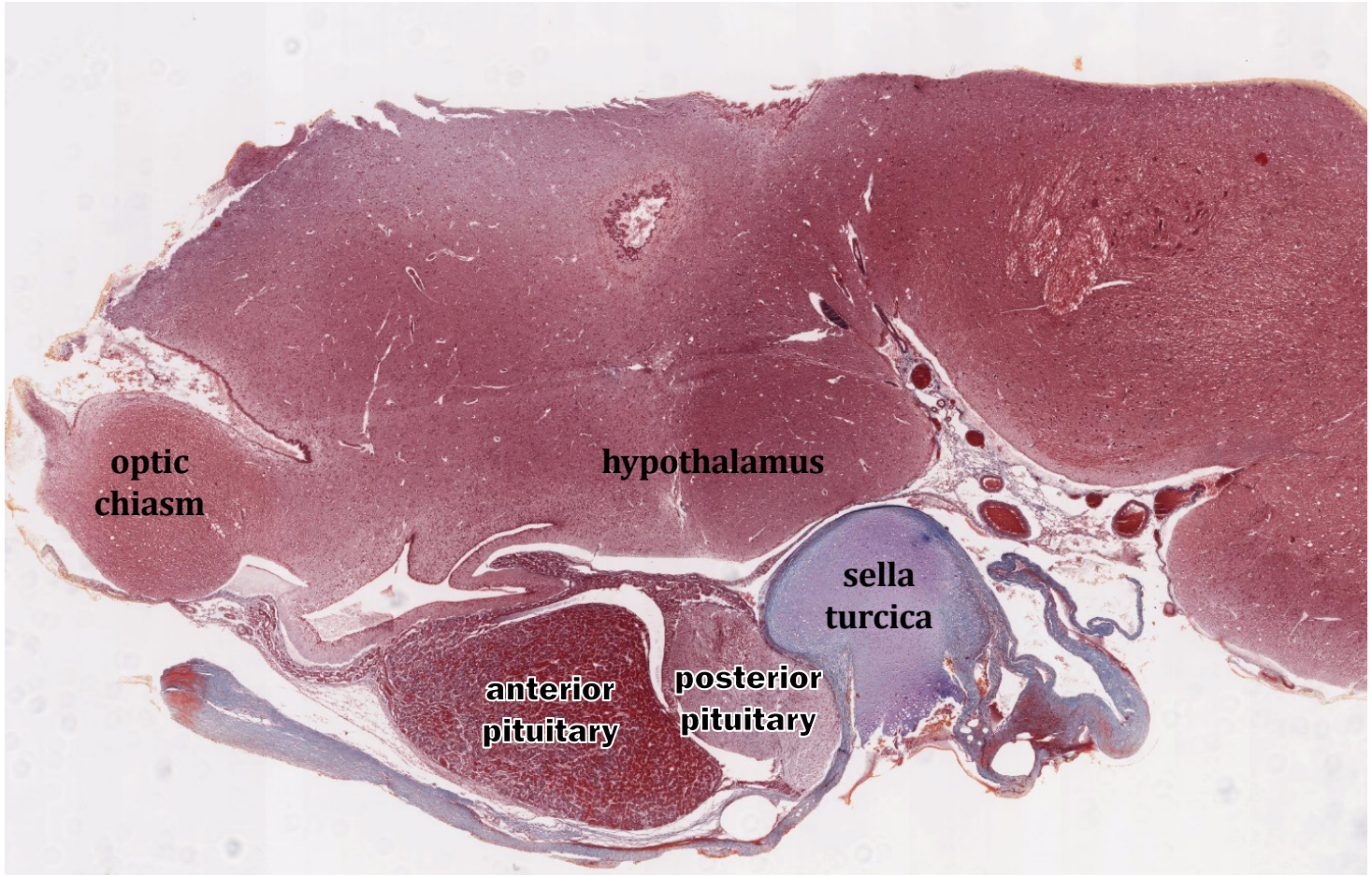
Slide 192 (NW): Hypophysis, Trichrome

Slide Overview



the above slide shows the **pituitary gland** (**hypophysis**) *in situ*, within the sella turcica (Lt. "Turkish saddle") of the sphenoid bone, demonstrating its close proximity to the optic chiasm and its relationship to the **hypothalamus** of the brain; the hypothalamus is involved in controlling body homeostasis and is thus the chief regulator of the hormonal activities of the pituitary gland (the "master gland")

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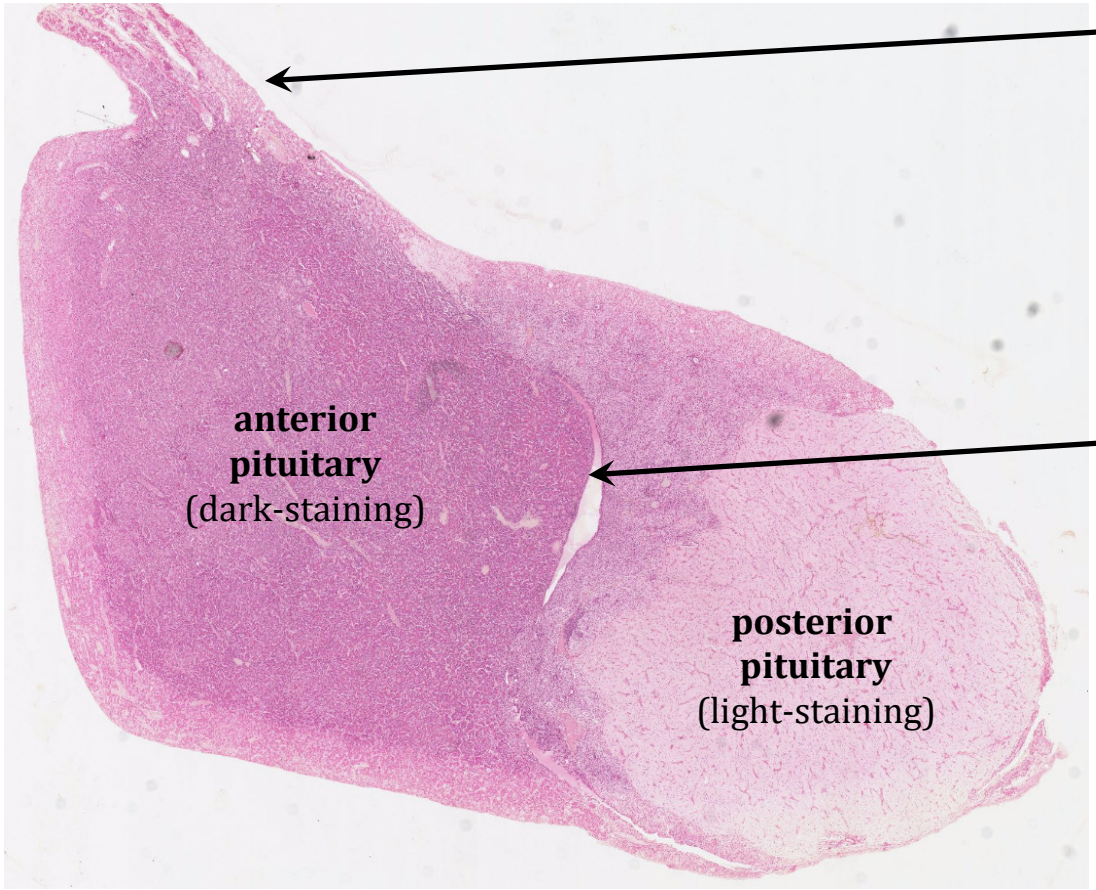
Slide 128: Pituitary, H&E



the **pituitary gland** (**hypophysis**) is a compound gland composed of two embryologically, functionally, and histologically distinct regions: the **anterior pituitary** containing epithelium and the **posterior pituitary** containing nervous tissue; the two regions are separated by the **pars intermedia** (part of the anterior pituitary); the hypothalamus connects directly to the posterior pituitary via a short stalk of nervous tissue called the **infundibulum**, while it "connects" to the anterior pituitary via a vascular **hypophyseal portal system**

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Slide 191 (NW): Hypophysis, H&E

the **anterior pituitary** (**adenohypophysis**) consists of three subdivisions: the **pars distalis** (anterior lobe) which composes the majority of the tissue, the **pars tuberalis** which surrounds the infundibulum, and the **pars intermedia** which is adjacent to the pars nervosa (posterior pituitary) and is characterized by multiple colloid-filled follicles of unknown significance; the **posterior pituitary** (**neurohypophysis**) consists of the **pars nervosa** (posterior lobe) and the **infundibulum** which connects to the hypothalamus

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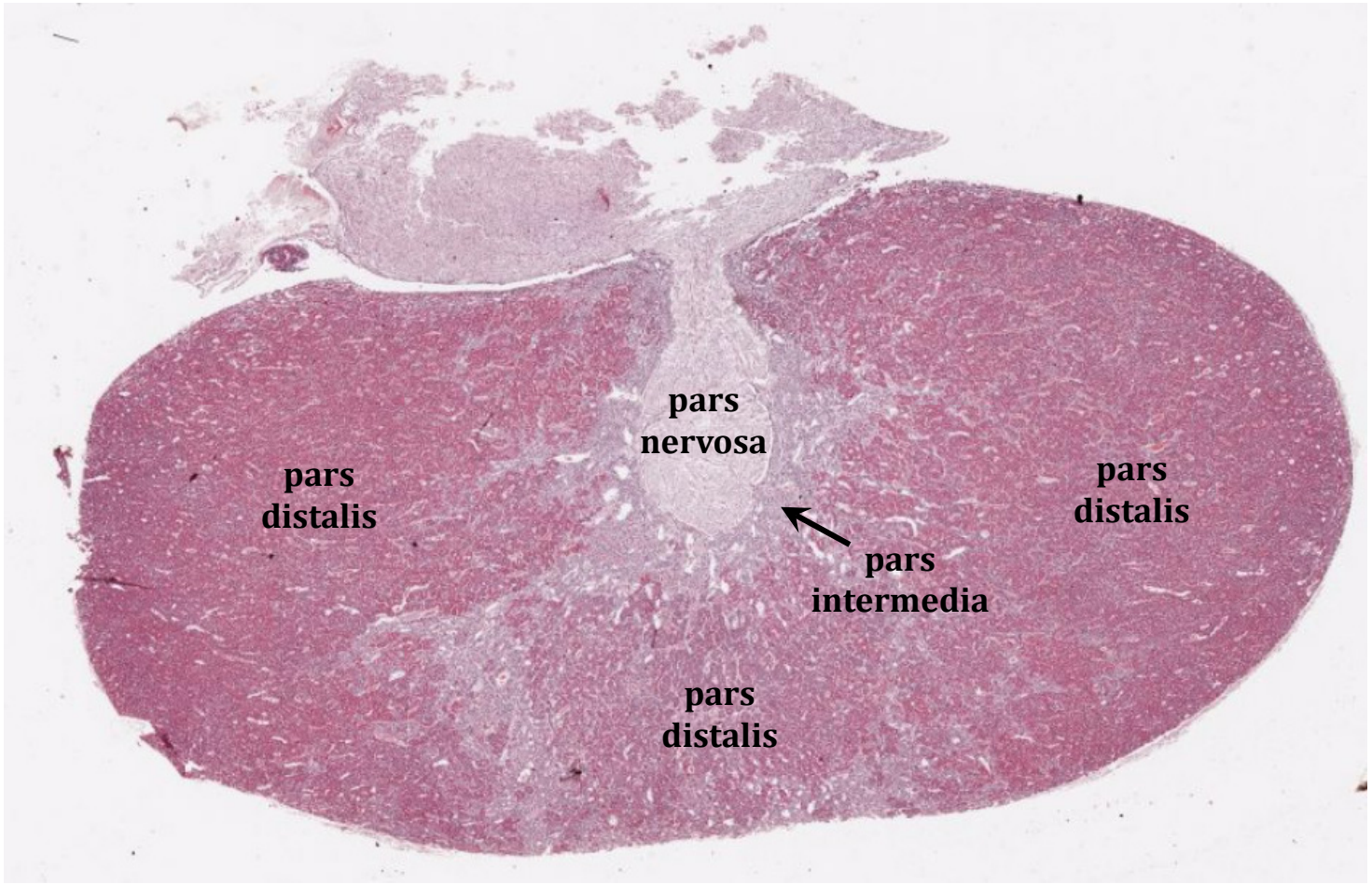
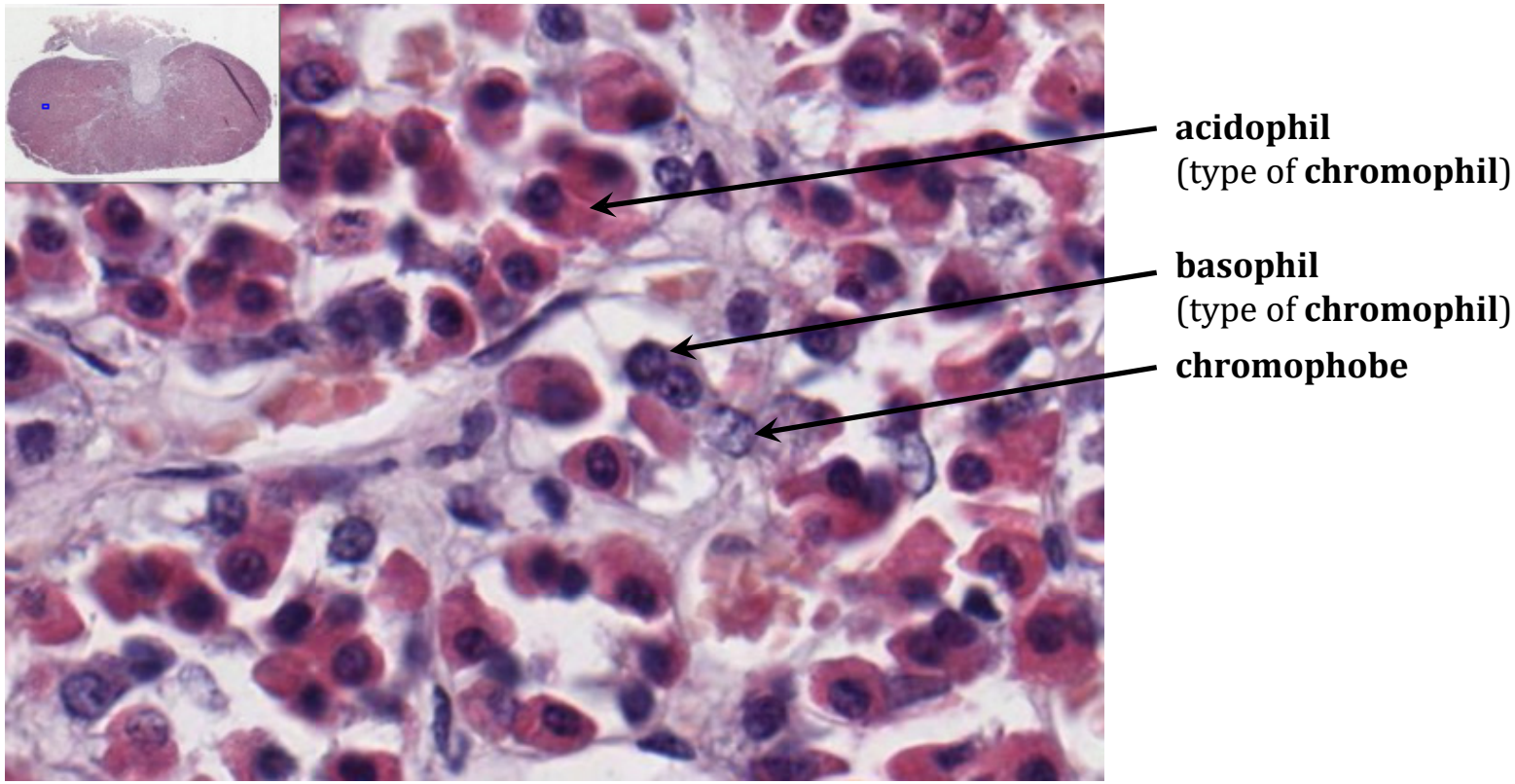
Slide 103: Anterior Pituitary, H&E



Slide 122: Pituitary, H&E



cells of the **anterior pituitary** (**pars distalis** shown above) are classified according to their cytoplasmic affinity for stains: **acidophils** have strongly-staining acidophilic (eosinophilic) cytoplasm; different types of acidophils secrete *growth hormone* and *prolactin*; **basophils** (less numerous) have strongly-staining basophilic cytoplasm; different types secrete *ACTH*, *FSH*/*LH*, and *TSH*; **chromophobes** are identified by their pale-staining cytoplasm and absence of secretory granules; they represent several different types of cells, including stem cells and degranulated cells

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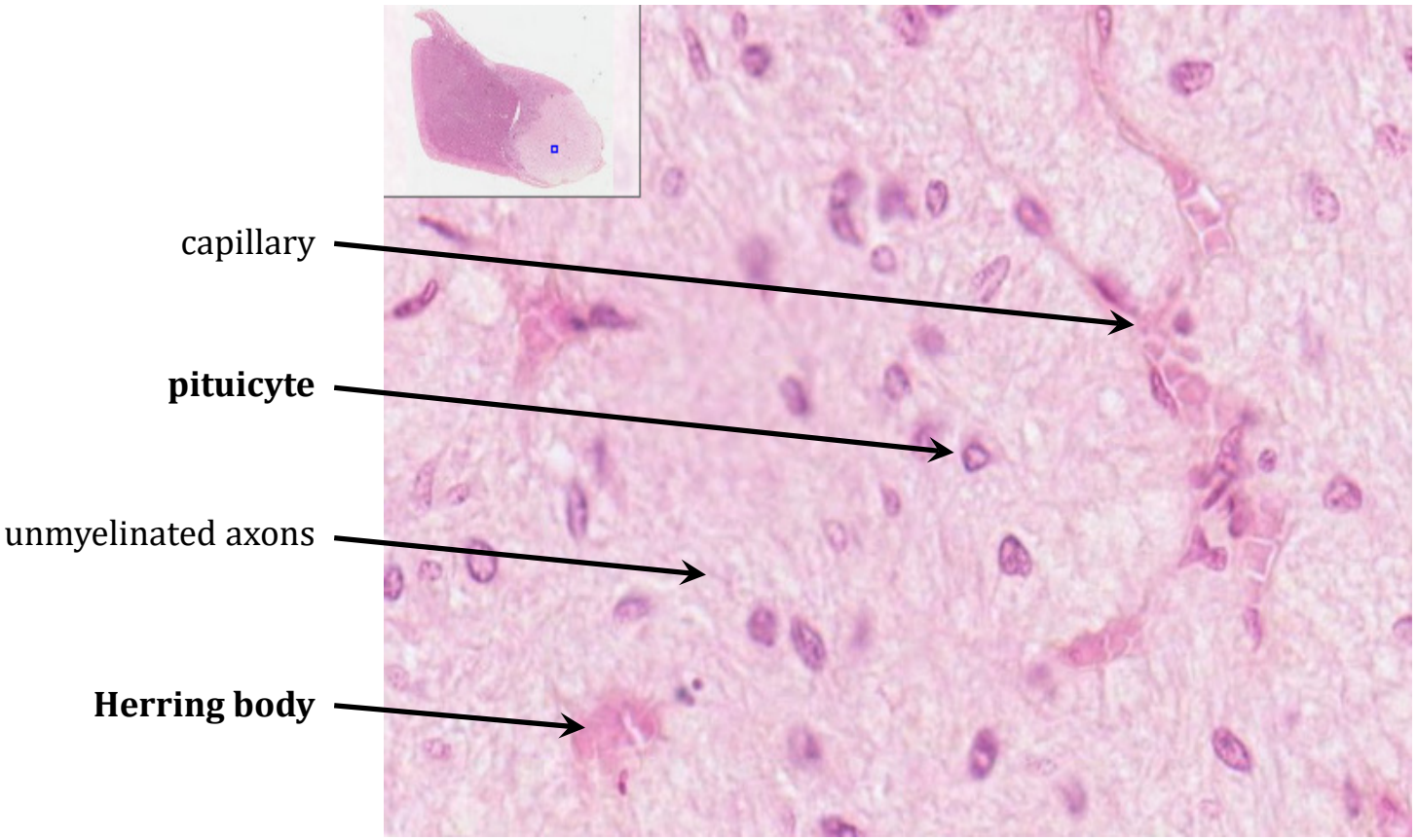
Slide 128: Pituitary, H&E



the **pars nervosa** (posterior lobe) is composed primarily of unmyelinated axons – not collagenous CT – which are part of the **hypothalamo-hypophyseal tract**; the cell bodies of the axons are located in the supraoptic and paraventricular nuclei of the hypothalamus where they synthesize *ADH* and *oxytocin* which are then transported down the axons into the pars nervosa to their neurosecretory terminal ends called **Herring bodies** to await release into the blood (nothing is synthesized in the posterior pituitary); **pituicytes**, a type of glial cell, are the majority of nuclei seen above and function to support the axons

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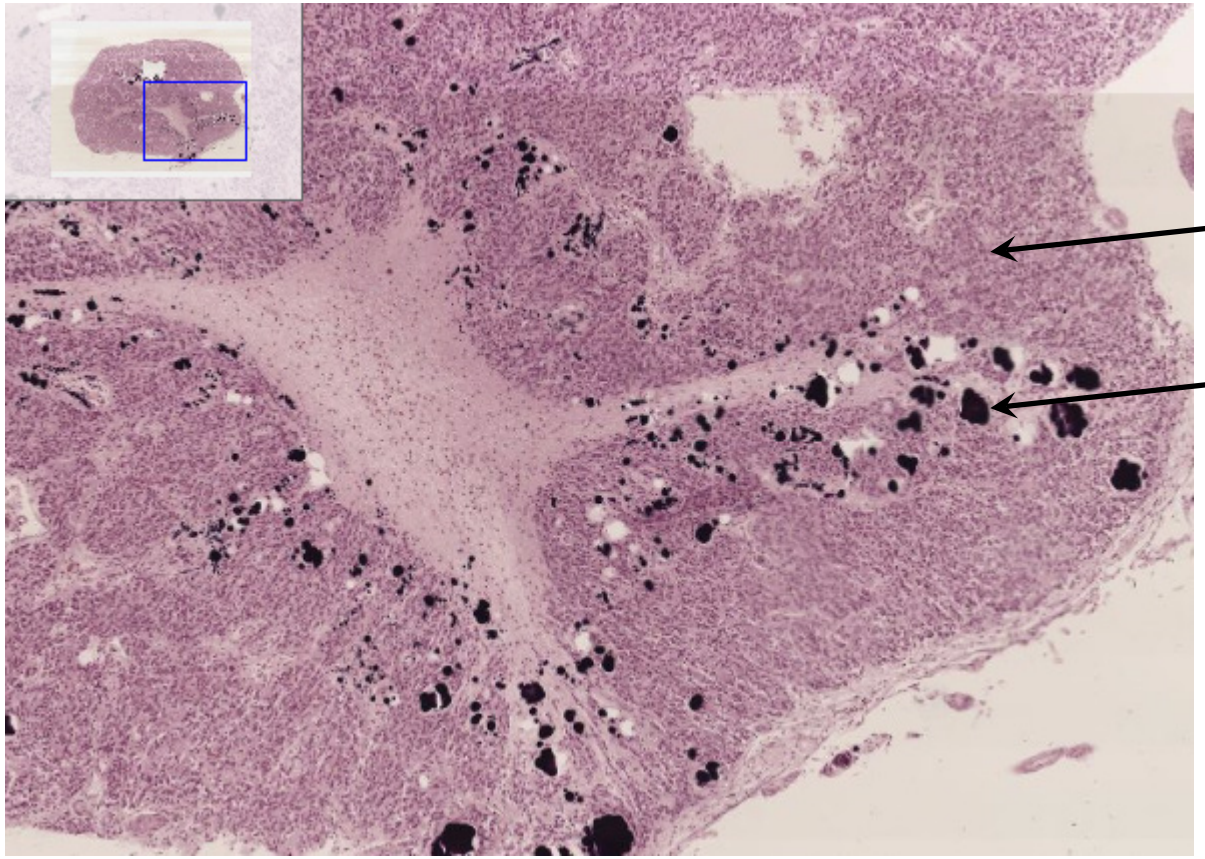
Slide 200 (NW): Pineal, H&E



the **pineal gland** is located along the posterior wall of the third ventricle in the brain; it is a photosensitive gland that regulates body rhythms chiefly through the release of *melatonin* (in the absence of light) from **pinealocytes**, the principal cells of the gland

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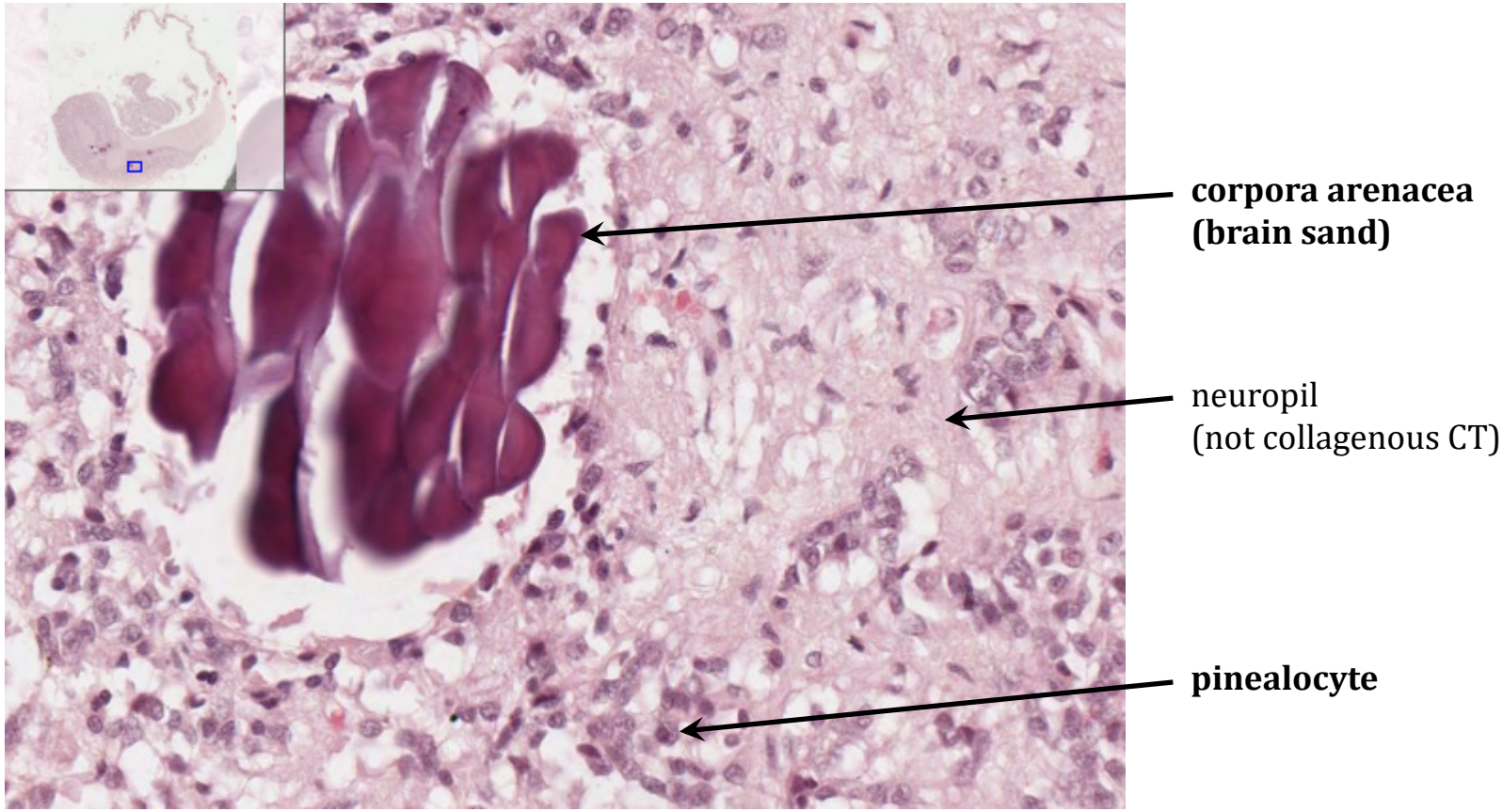
Slide 106: Pineal, H&E



pinealocytes are the principal cells of the pineal gland; they are arranged in clumps of cells and have large rounded – or indented – nuclei usually with prominent nucleoli; the cytoplasm is slightly basophilic and contains lipid droplets; **corpora arenacea** (Lt. “sandy bodies”) are a readily identifiable characteristic of the pineal gland – they do not serve a known physiologic function but are useful radiographic markers

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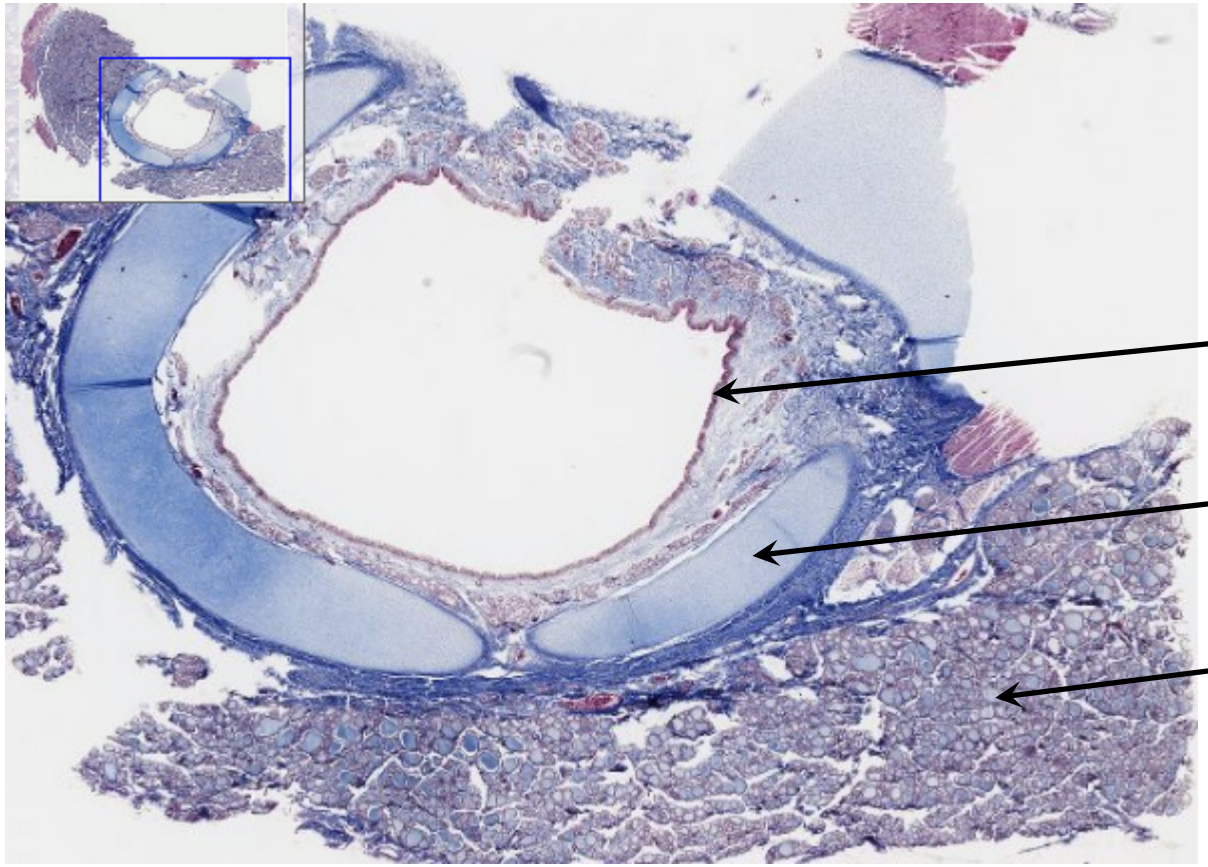
Slide 2: Trachea and Thyroid, Trichrome



the **thyroid gland** is a bi-lobed gland surrounding the anterolateral portions of the trachea; it is characterized and easily recognized by the presence of numerous tightly-packed, colloid-filled **follicles**; it secretes *thyroid hormones* (T4/T3) which regulate metabolism and *calcitonin* which decreases serum calcium levels

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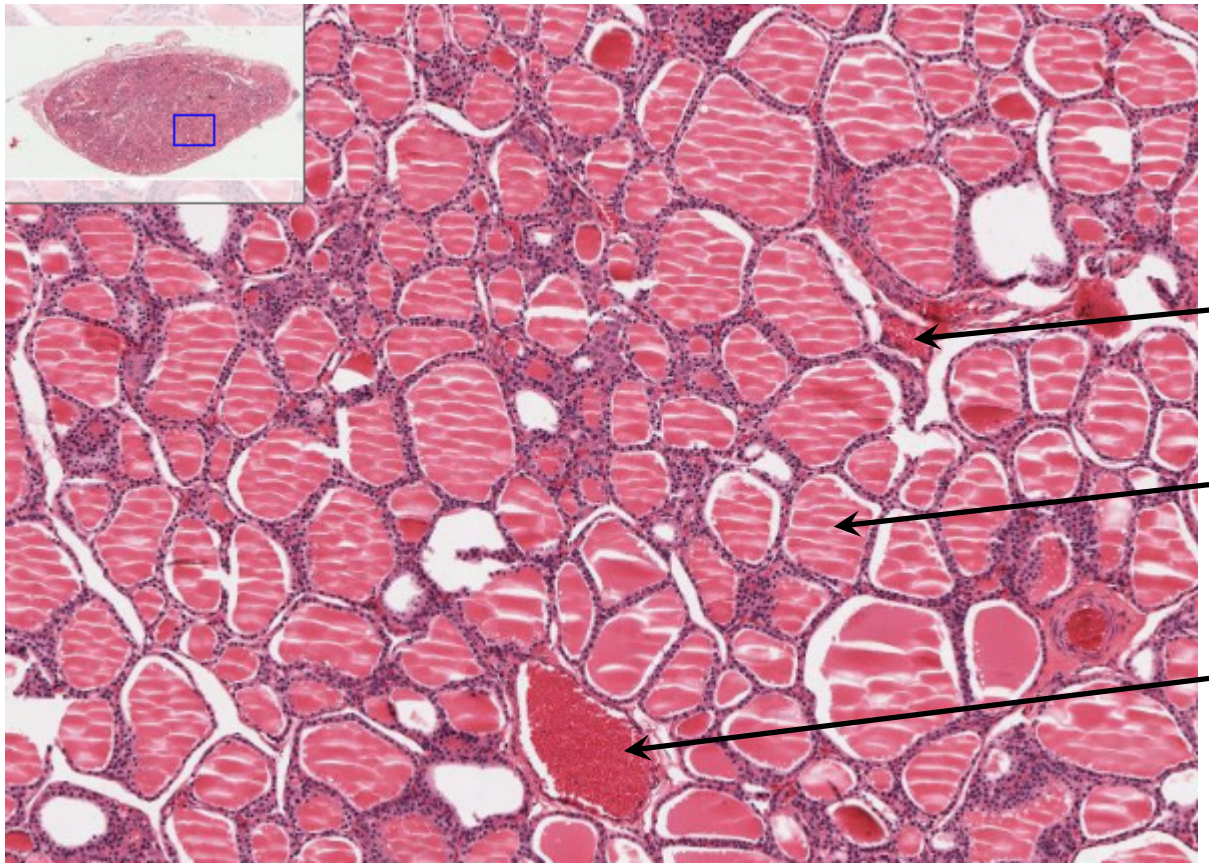
Slide 194 (NW): Thyroid, H&E



the **thyroid gland** is characterized by **follicles** filled with eosinophilic **colloid** consisting of *thyroglobulin*; the colloid is synthesized by the **follicular cells** which form the wall of the lumen, thus the cells are exocrine cells; the thyroglobulin is also resorbed by the follicular cells and formed into active thyroid hormones (T4/T3) which are then released into the circulation, thus the cells are also endocrine cells

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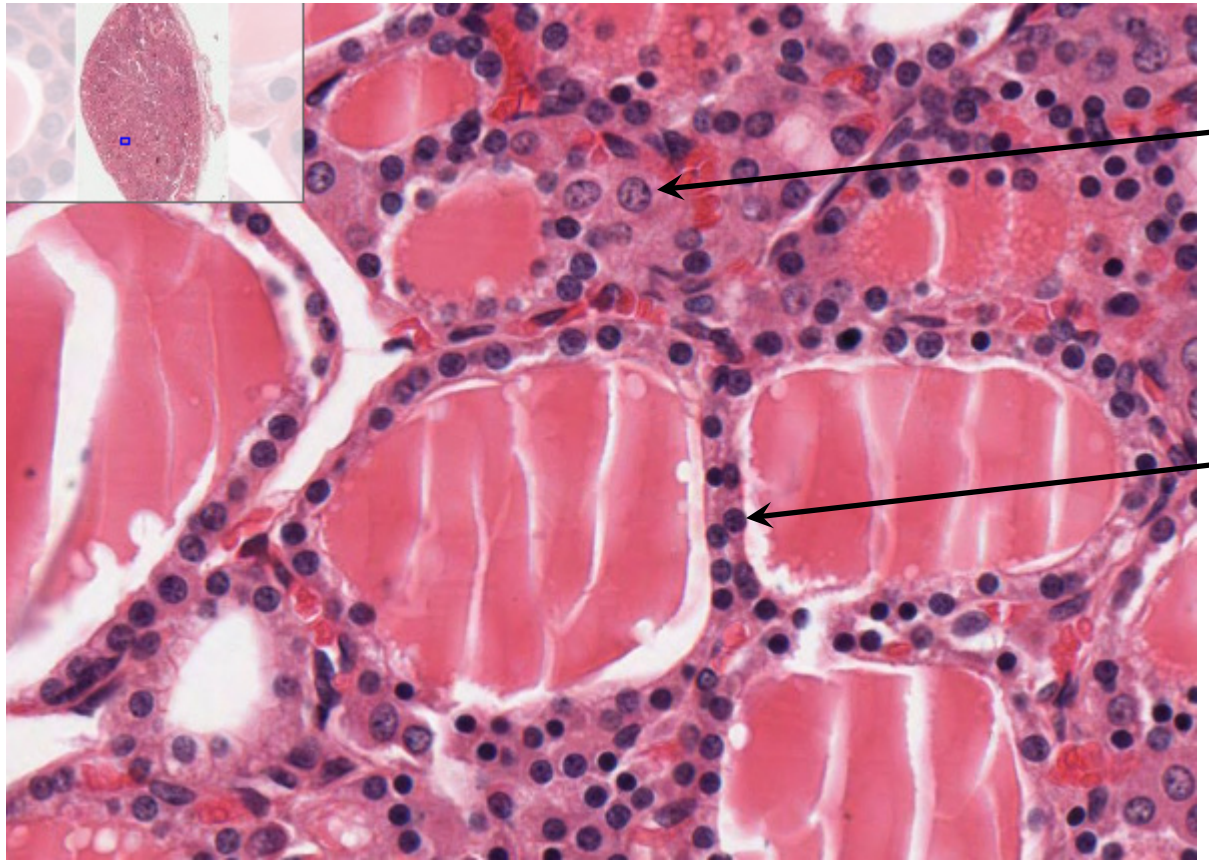
Slide 194 (NW): Thyroid, H&E



the **thyroid gland** consists of two major cell types: **follicular cells** are cuboidal epithelial cells that line the lumens of the follicles; they generally have abundant rough ER and a prominent Golgi apparatus; **parafollicular cells**, which secrete *calcitonin*, can be difficult to definitively identify on routine human samples; they may appear larger and lighter-staining than the follicular cells, and may be seen as single cells or clumps of cells located to the periphery of the follicles or in the interstitial CT between the follicles

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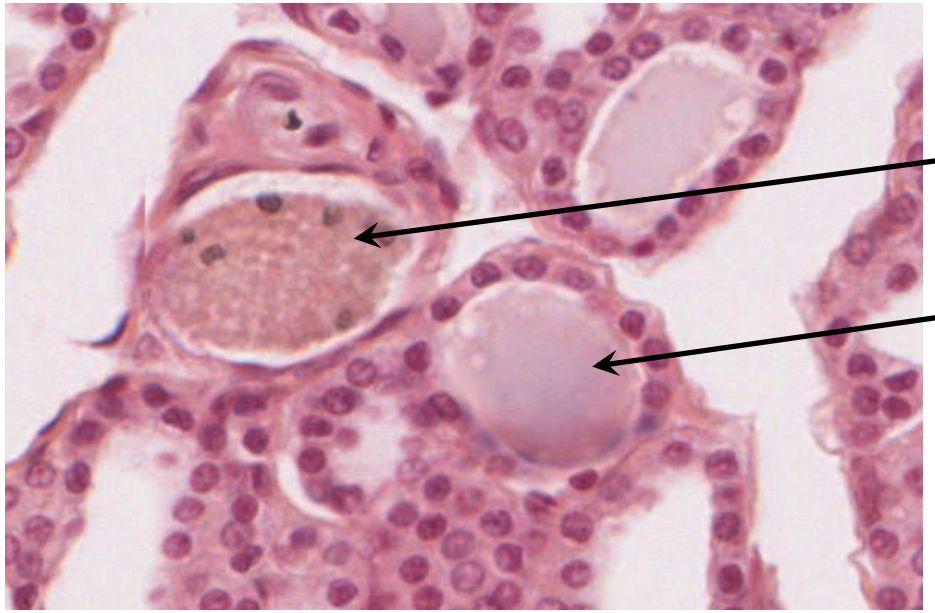
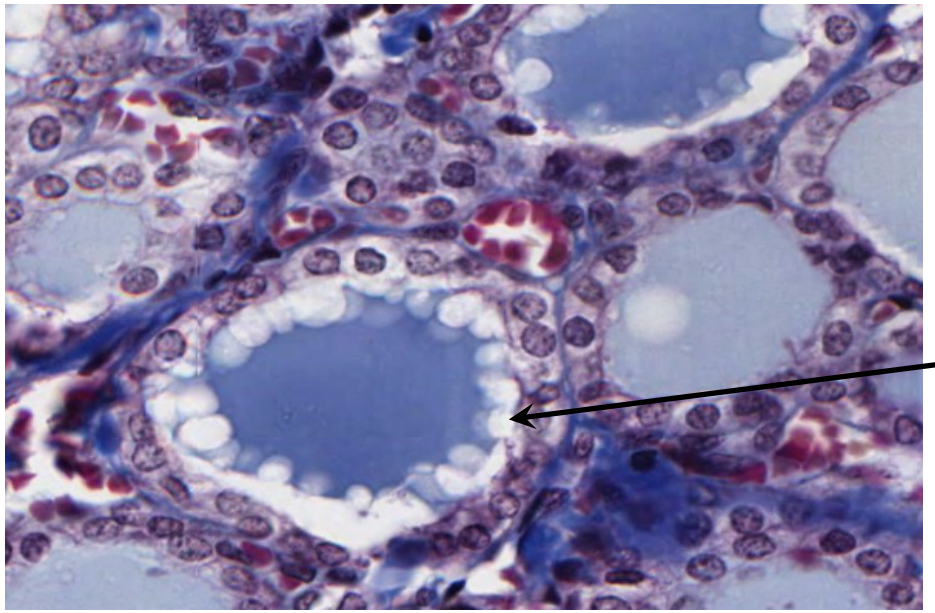
Slide 195 (NW): Thyroid and Parathyroid, H&E



venule lined by simple squamous endothelium

follicle filled with **colloid** and lined by simple cuboidal follicular cells

Slide 2: Trachea and Thyroid, Trichrome



resorption lacunae demonstrate active follicles as the colloid is being resorbed by the follicular cells to be secreted as thyroid hormones

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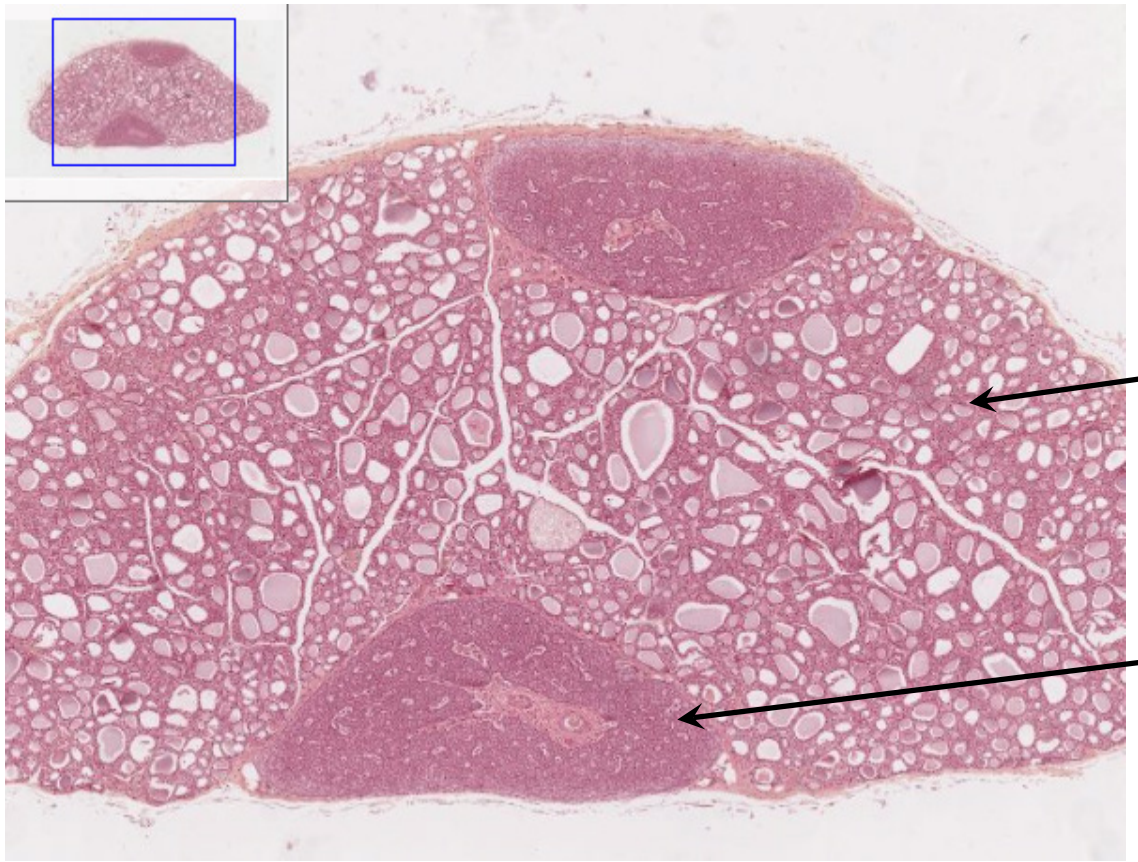
Slide 195 (NW): Thyroid and Parathyroid, H&E



look here for the **thyroid gland**

notice all the large **follicles** filled with **colloid**

look here for the **parathyroid gland**

notice the lack of follicles

there are generally four small **parathyroid glands** embedded on the posterior aspect of the thyroid gland; the thyroid and parathyroid glands are separated by a thin connective tissue capsule; the parathyroid glands are usually easily distinguished from the thyroid gland by the lack of follicles

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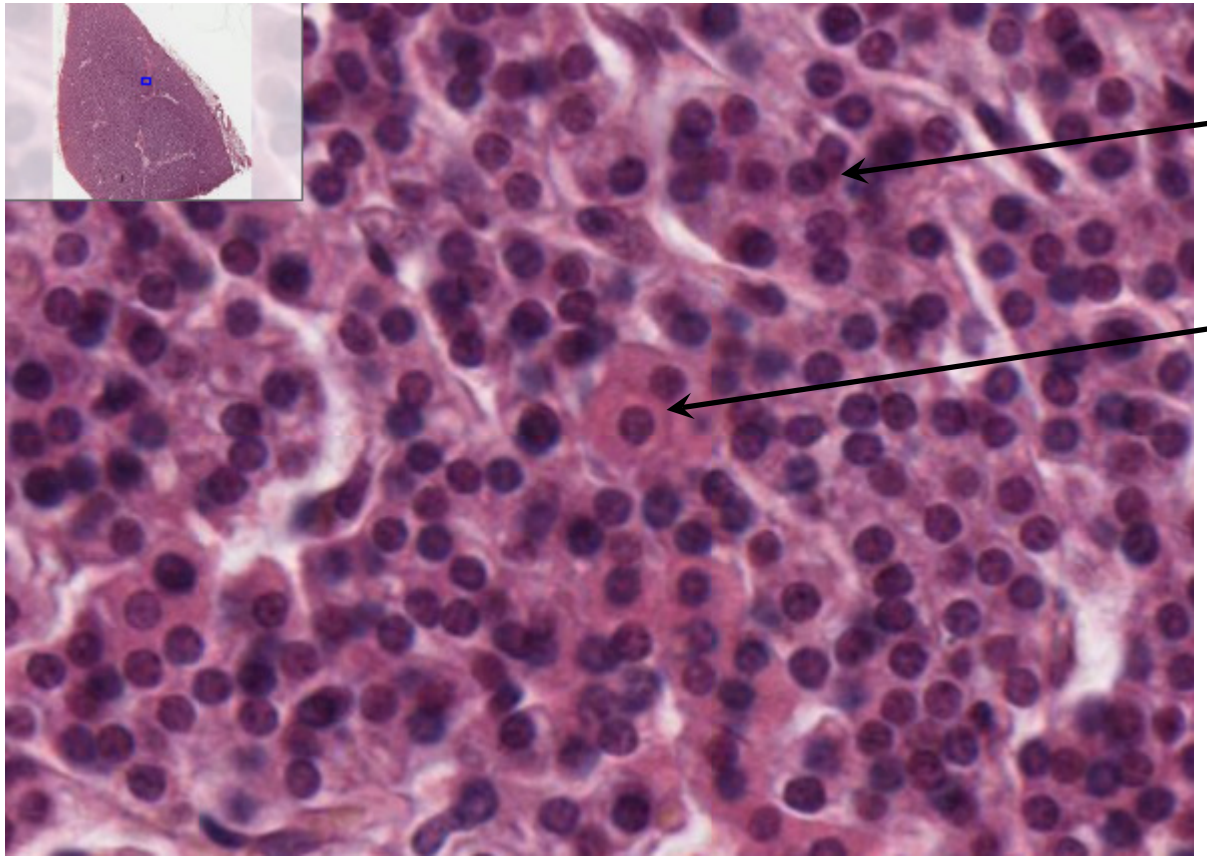
Slide 69: Parathyroid, H&E



the **parathyroid glands** consist of two major cell types arranged in cords and clumps of cells: **principal cells** are non-distinct cells that produce *parathyroid hormone (PTH)* which increases serum calcium levels; **oxyphil cells** (Gr. “acid loving”) are larger and have an eosinophilic cytoplasm full of mitochondria, but have no known function; they may be found individually or in small clumps of cells and usually appear around puberty and increase in number with age

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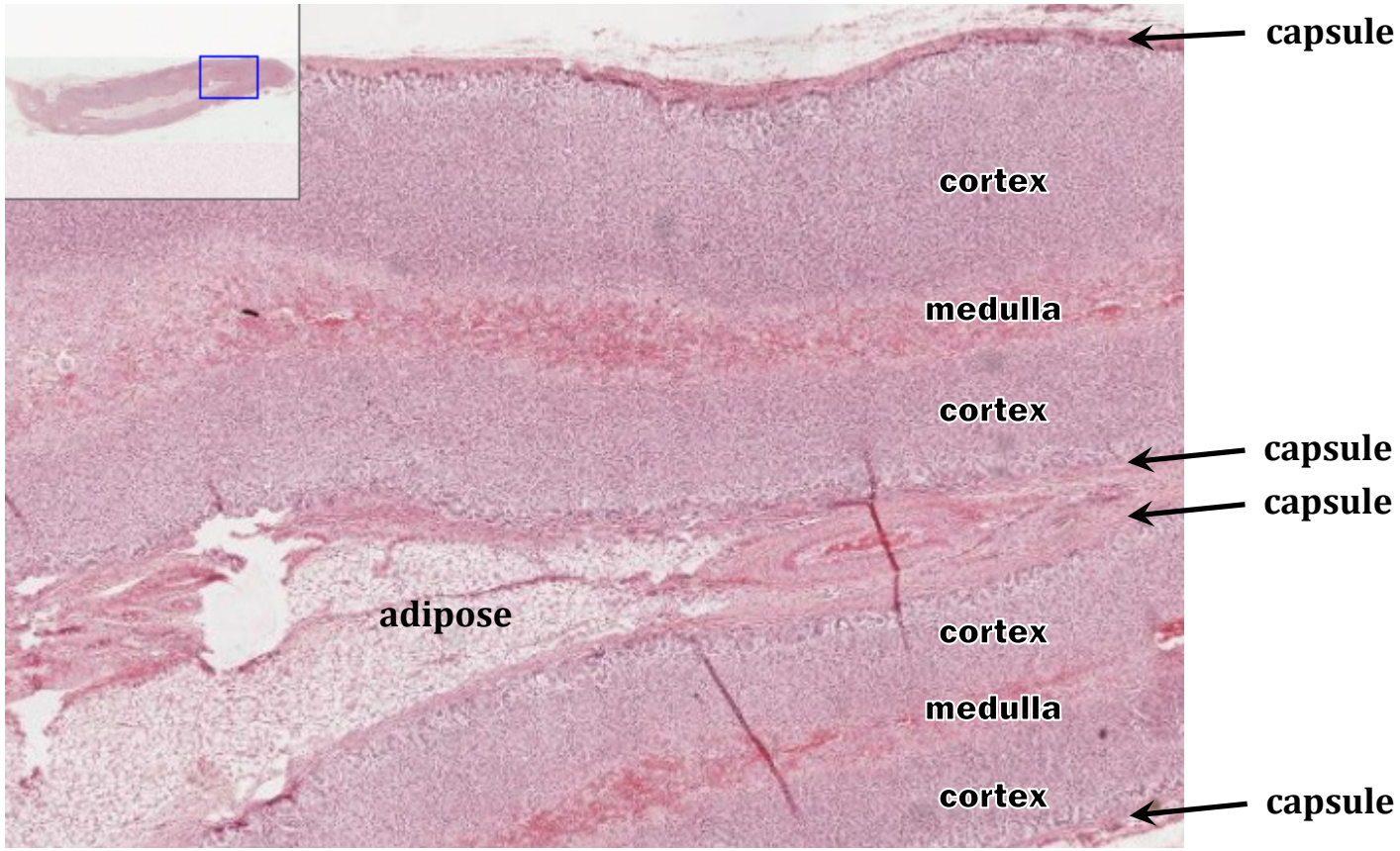
Slide 102: Adrenal Gland, H&E



the **adrenal** (**suprarenal**) **glands** are small compound endocrine glands located on the superior pole of each kidney; each gland is surrounded by a dense CT capsule and contains two embryologically, functionally, and histologically distinct regions: the darker-staining **cortex** secretes *steroid hormones* made from cholesterol, and the lighter-staining **medulla**, essentially a sympathetic ganglion, secretes *catecholamines* (epinephrine and norepinephrine); note that the slide above shows the gland as "folded" around surrounding adipose tissue, not to be confused for the medulla of the gland

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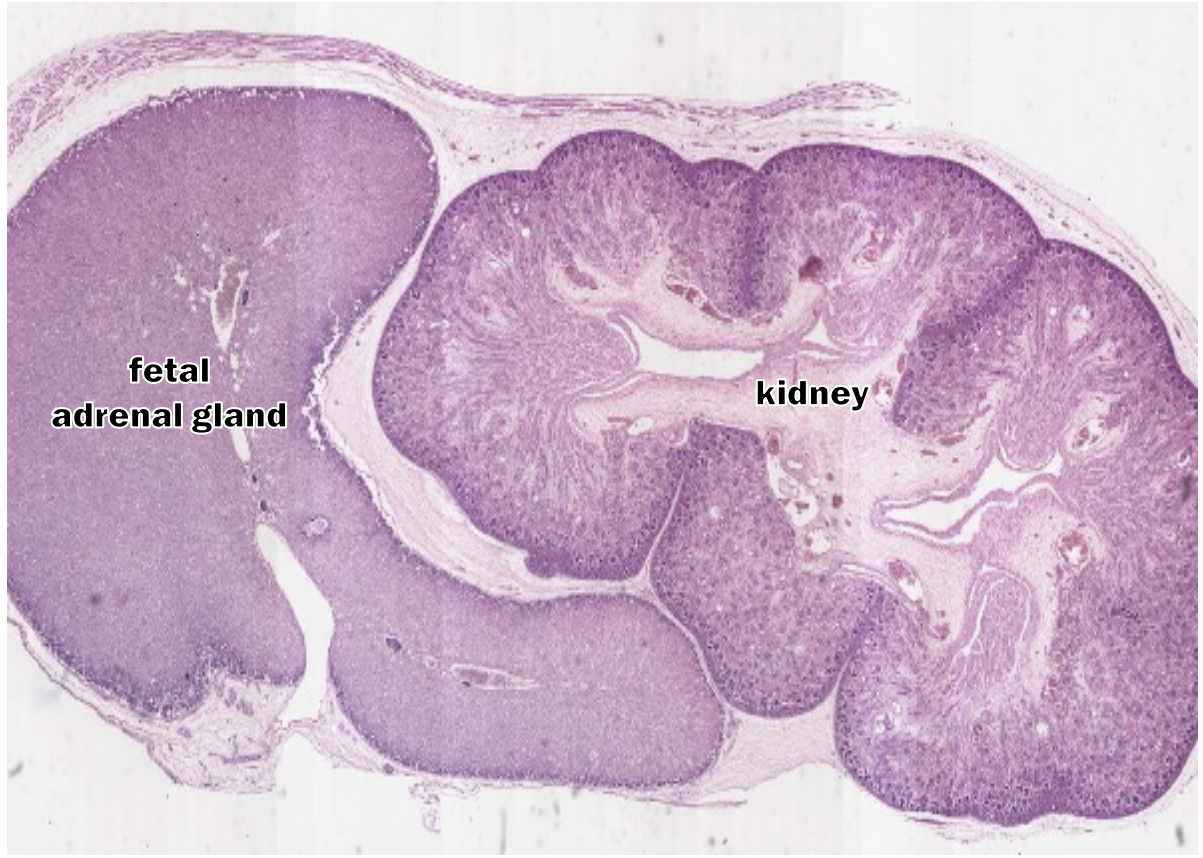
Slide 198 (NW): Suprarenal Gland with Kidney, H&E



the **fetal adrenal gland** is relatively large compared to the other fetal organs, but it lacks a defined medulla and the bulk of the cortex is composed of cords of cells, called the **fetal zone**, which regress after birth; by birth the glands produces twice as much total steroid hormones as do the adult glands – however they are incapable of completing all the necessary steps of steroid synthesis so they work with the placenta as a combined **fetal-placental unit** to synthesize functional hormones; soon after birth the fetal zone undergoes a rapid regression, and the adrenal gland with an “adult” cortex and medulla then develops during the first few years of life

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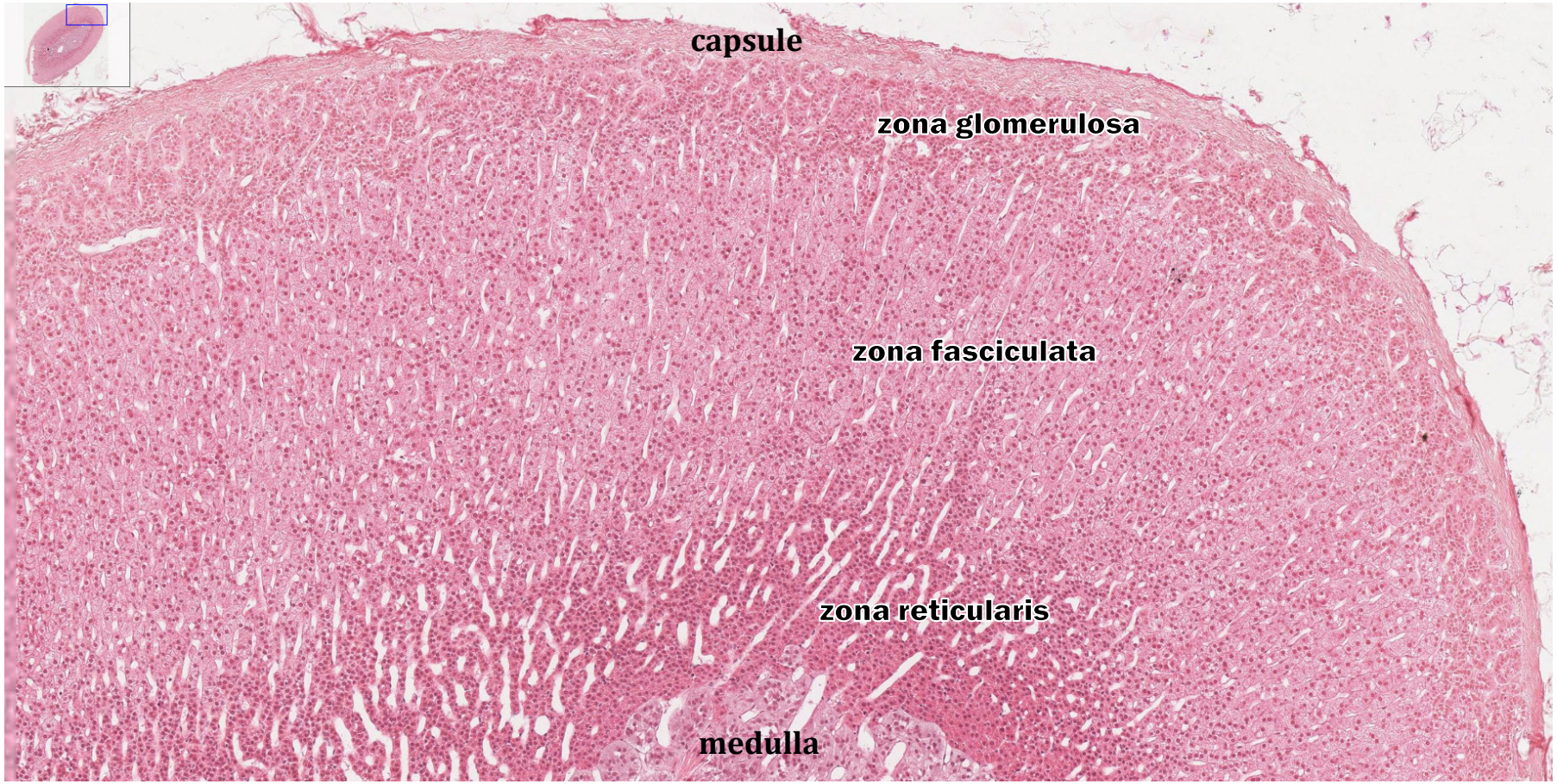
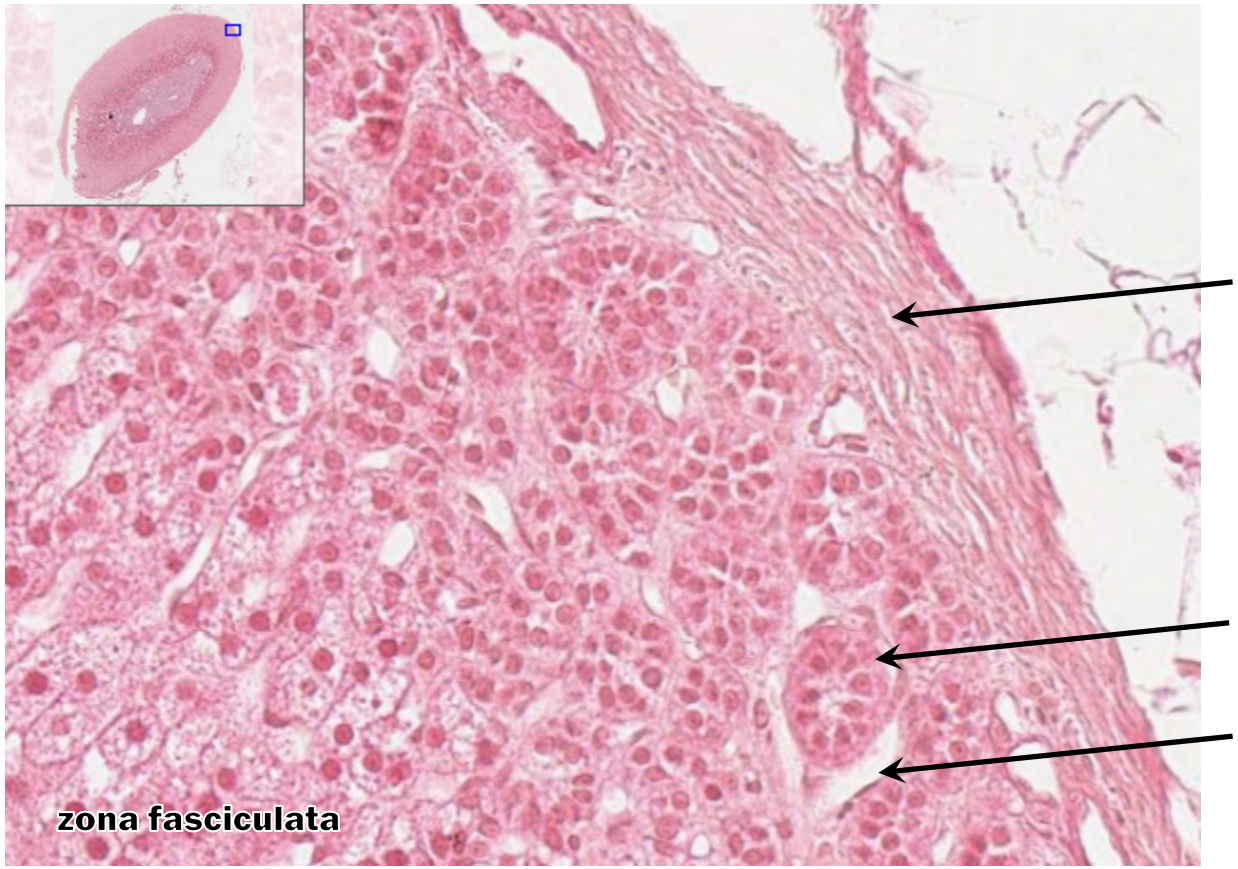
Slide 75: Adrenal Gland, H&E



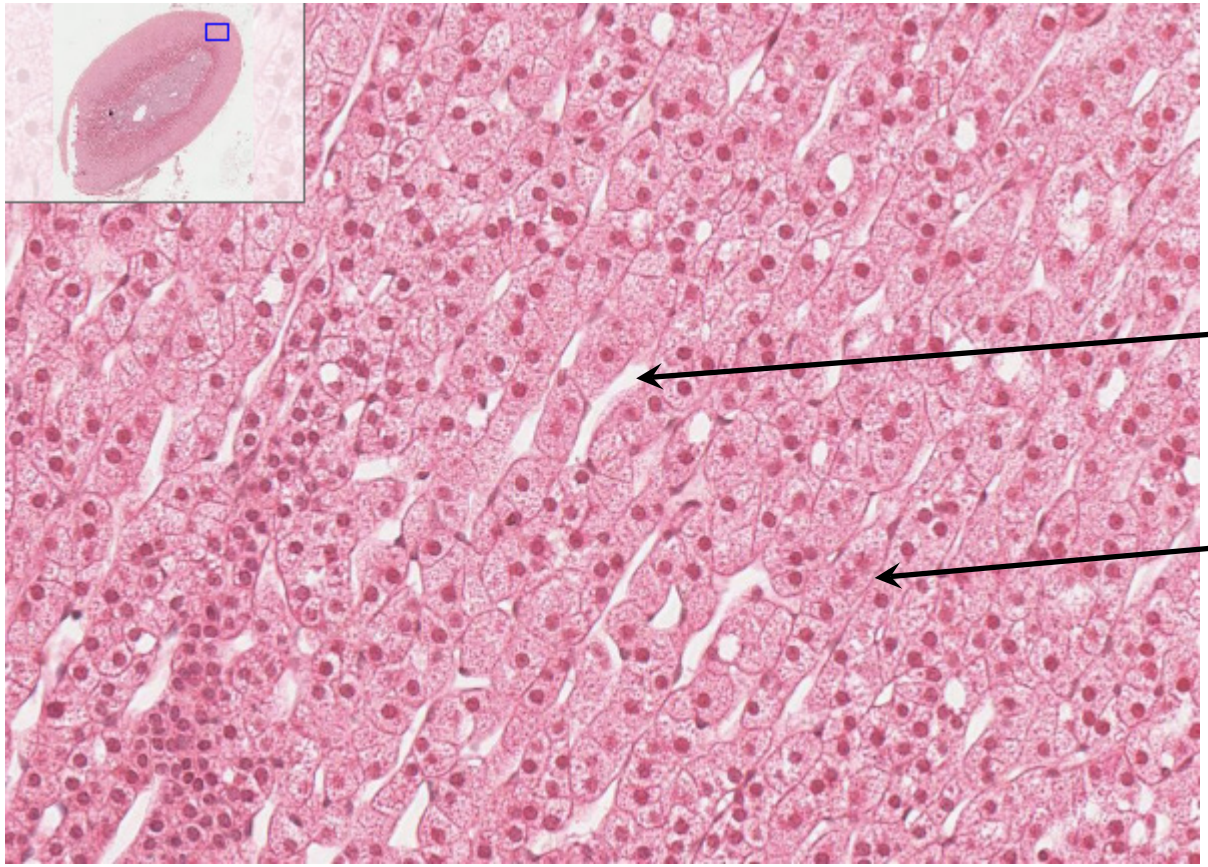
the steroid-producing **cortex** of the **adrenal glands** is organized into three concentric zones which each produces a principal type of steroid hormone: the outer **zona glomerulosa** produces *mineralocorticoids* (*aldosterone*), the middle **zona fasciculata** produces *glucocorticoids* (*cortisol*), and the inner **zona reticularis** produces *sex hormones* (*androgens*); the order of the layers can be remembered with the simple mnemonic *GFR* (denoting the gland's association with the kidney) or *Go Find Rex, Make Good Sex* which includes the hormones

Slide 75: Adrenal Gland, H&E



the **zona glomerulosa** (Lt. "ball-shaped") is directly adjacent to the capsule and contains cells arranged in small ball-shaped clusters (not to be confused with ducts – which endocrine glands lack); surrounding the cell clusters are numerous sinusoidal capillaries (sinusoids); the cells produce *mineralocorticoid steroid hormones* (*aldosterone*) which leads to increased sodium reabsorption (and potassium excretion) in the distal tubules of the kidney (water follows the sodium thereby leading to an increase in blood pressure)

Slide 75: Adrenal Gland, H&E



the **zona fasciculata** (Lt. "little bundle") is the middle and the thickest of the cortical layers; the cells are arranged in long parallel cords (1 or 2 cells thick) running perpendicular to the surface of the gland; the cells have the typical appearance of steroid-producing cells and contain more lipid droplets than in the other layers giving the layer an overall lighter-staining appearance; the cords are separated by numerous sinusoidal capillaries (sinusoids); the cells produce *glucocorticoid steroid hormones* (*cortisol*) which have a wide range of effects on nearly every tissue in the body

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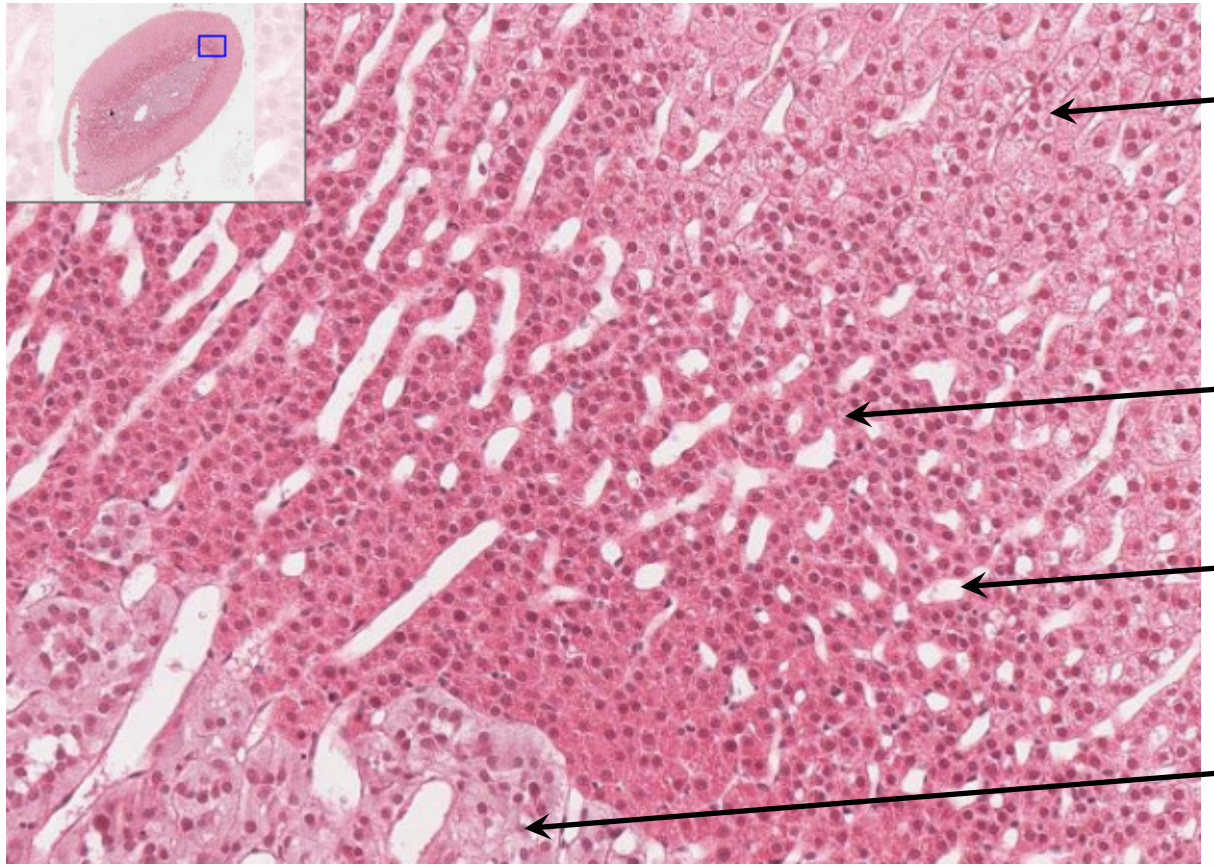
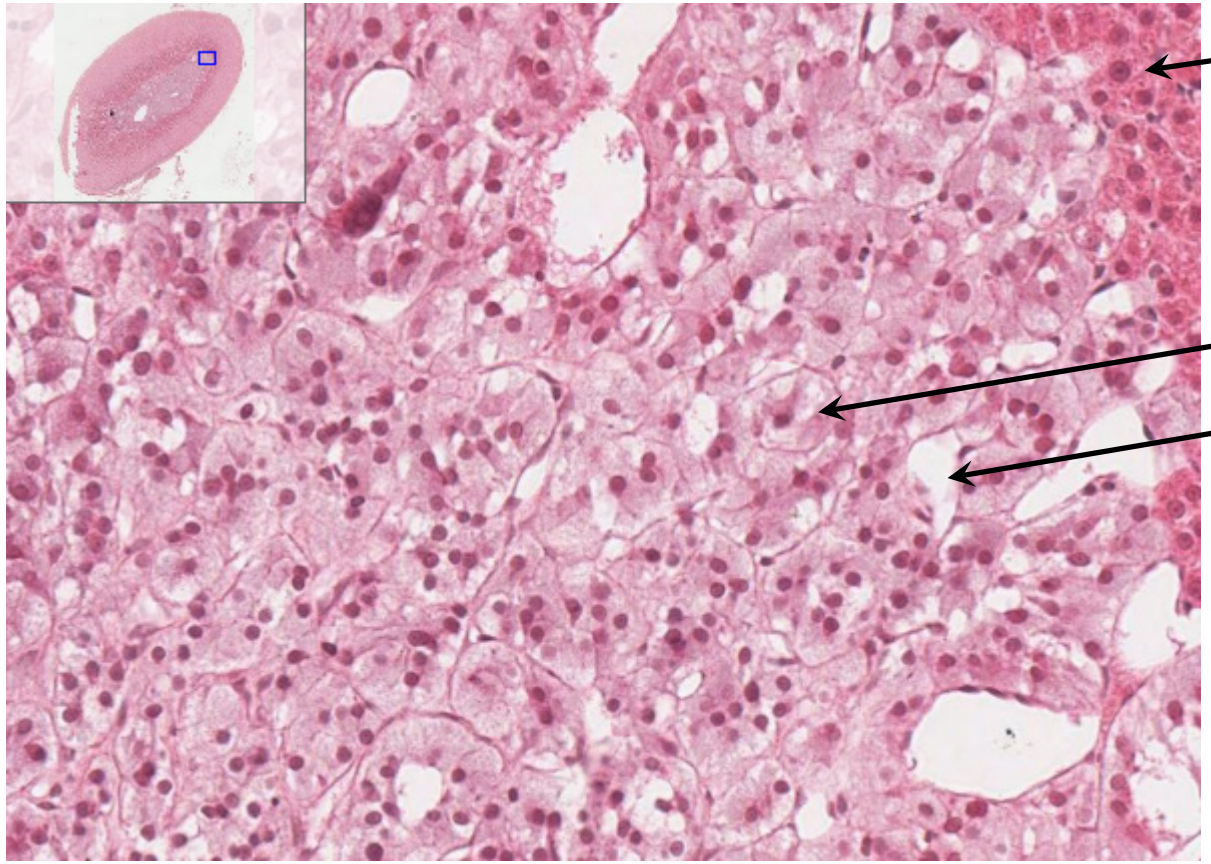
Slide 75: Adrenal Gland, H&E



the **zona reticularis** (Lt. "net-like") is the innermost cortical layer and borders the medulla; the cells are arranged into a network of anastomosing cords which are separated by numerous sinusoidal capillaries (sinusoids); the cells have less cytoplasm than in the other layers so pack more tightly together thus giving the layer a darker-staining appearance than the adjacent zona fasciculata or the medulla; the cells produce *sex hormones* (*weak androgens*, e.g. *DHEA*) which are functionally more important in females than in males

Slide 75: Adrenal Gland, H&E



the **medulla** of the adrenal gland is comparable to a sympathetic ganglion but releases its *catecholamines* (*epinephrine* and *norepinephrine*) into the blood instead of at synapses; the **chromaffin cells** are large, pale-staining, polyhedral cells; they are arranged into clumps or cords surrounded by numerous sinusoidal capillaries (sinusoids) which drain into larger blood vessels prominent in the medulla

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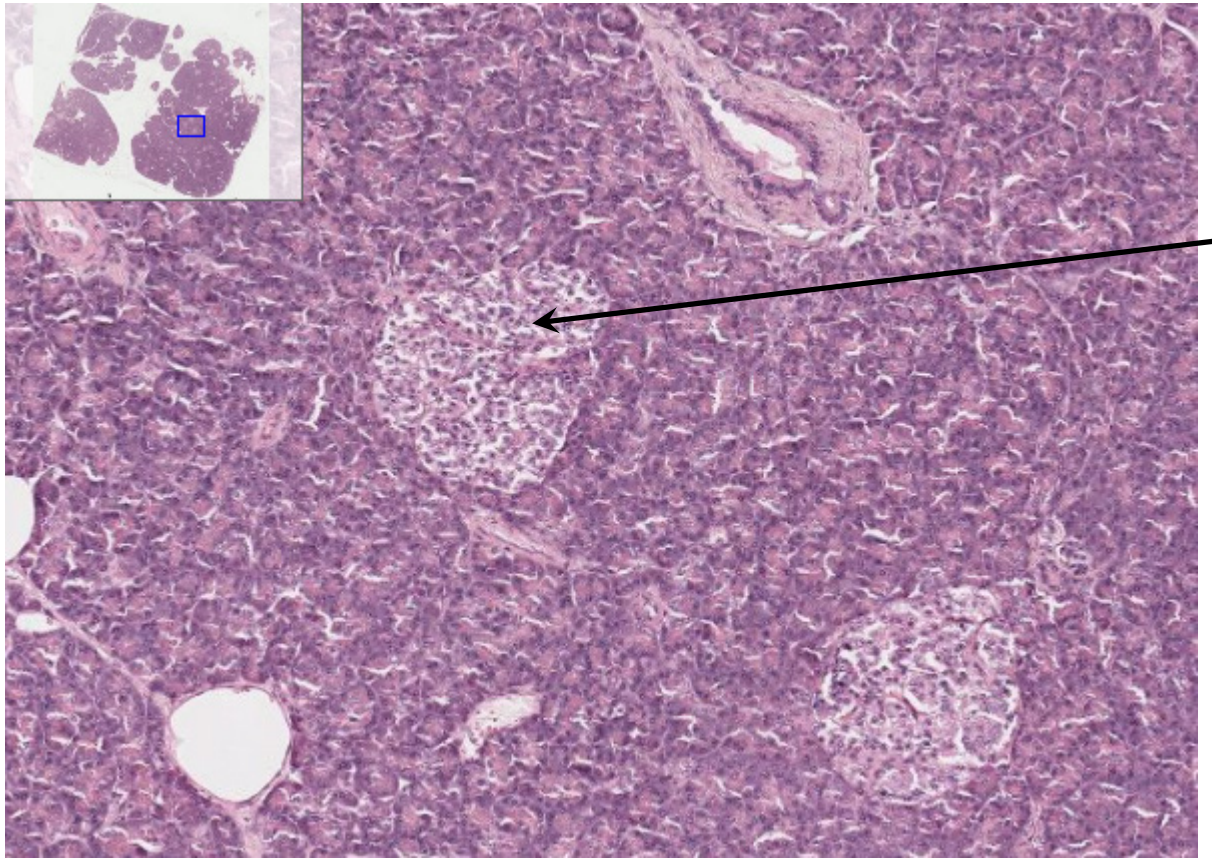
Slide 154: Pancreas, H&E



pancreatic islet (islet of Langerhans)

lighter-staining than the surrounding serous acini of the exocrine pancreas

pancreatic islets are most numerous in the tail region of the pancreas

the endocrine portion of the **pancreas** is composed of discrete cell clusters called **pancreatic islets** that contain a variety of cell types which produce various hormones including *insulin* (from beta cells) and *glucagon* (from alpha cells); the cells are arranged into cords surrounded by numerous sinusoidal capillaries (sinusoids); the individual cell types (e.g., α and β cells) cannot be distinguished in routine light microscopy

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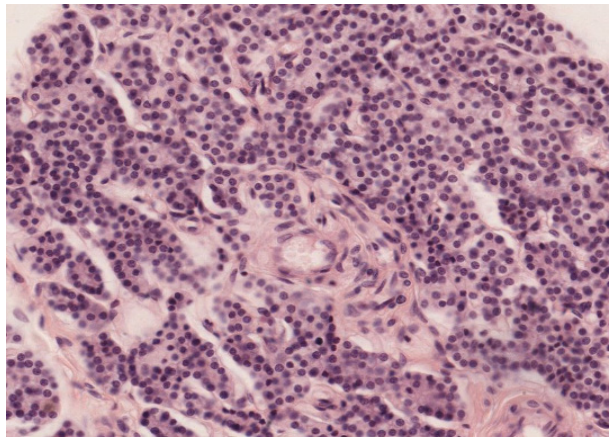
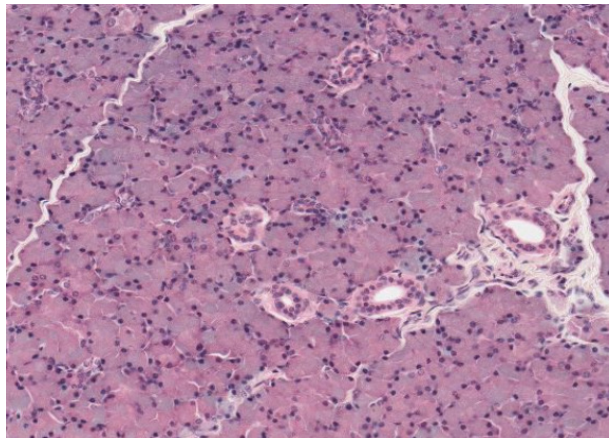
Common Confusion:
Parathyroid gland vs. Parotid gland



Parathyroid Gland

Parathyroid gland: small endocrine glands (usually four) located on the posterior of the thyroid gland; secrete parathyroid hormone (PTH) which increases serum calcium

Look for: (1) lack of exocrine ducts – not to be confused with blood vessels; (2) cords/clumps of cells separated by numerous sinusoids; (3) clusters of larger, eosinophilic oxyphil cells may be present; (4) cells are more tightly packed than the secretory acini cells of exocrine glands



Parotid Gland

Parotid gland: major salivary exocrine gland located anterior to the ear; composed almost exclusively of serous acini that produce a thin watery secretion rich in enzymes

Look for: (1) intralobular ducts, with cuboidal epithelium, are readily visible; (2) cells are arranged into acini and appear less dense than in endocrine glands; (3) cells have a polarized appearance with nuclei located basally

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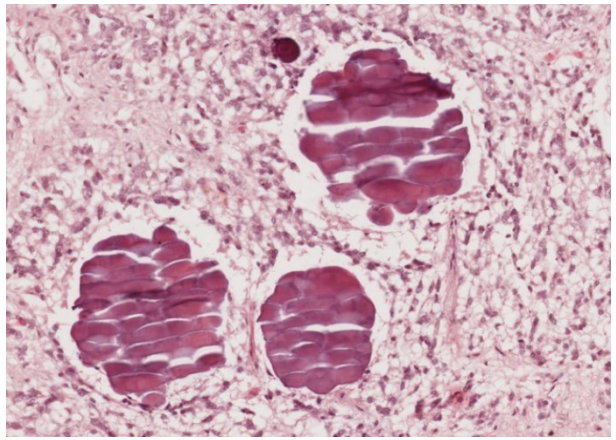
Common Confusion:

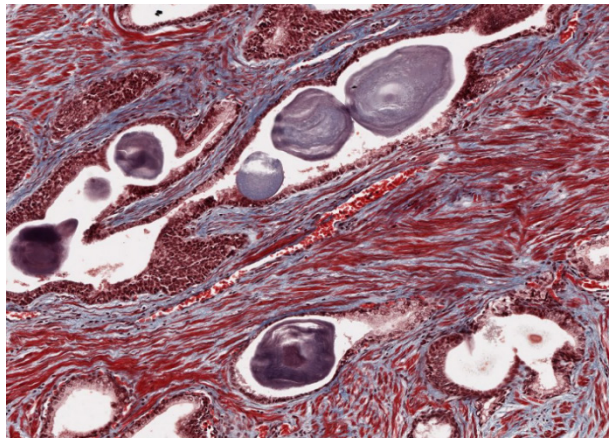
Corpora arenacea vs. Corpora amylacea



Pineal Gland

Corpora arenacea: (Lt. "sandy bodies") calcified structures generally found in the pineal gland but can be found elsewhere in the CNS including the choroid plexus and leptomeninges

Look for: (1) deposits generally lack concentric layers and may have a more "blobby" appearance; (2) in the pineal gland, concretions are surrounded by neuropil and pinealocytes – not within an epithelium-lined lumen



Prostate

Corpora amylacea: (Lt. "starchy bodies") generally found in the prostate gland but can be found elsewhere throughout the body, including the CNS; composed of glycoproteins and keratin sulfate that may become calcified

Look for: (1) "hyaline" appearance with concentric layers, like a starch granule; (2) in the prostate, concretions are located in lumens of glands lined by columnar epithelium; glands are surrounded by stroma of dense CT and smooth muscle

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I. Introduction
II. Keywords
III. Slides
  A. Pituitary Gland
    1. General structure
    2. Regions
      a. Anterior pituitary
      b. Posterior pituitary
  B. Pineal Gland
  C. Thyroid Gland
  D. Parathyroid Glands
  E. Adrenal (Suprarenal) Glands
    1. General structure
    2. Regions
      a. Cortex
      b. Medulla
  F. Endocrine Pancreas
IV. **Summary**

Characteristics and Functions of Cells of the Endocrine System

Cell	Location	Appearance	Hormone(s) Secreted	Hormone Effects
basophil cells				
parafollicular cell				
zona glomerulosa cell				
follicular cell				
β (beta) cell				
chromaffin cell				
oxyphil cell				
pinealocyte				
principal (chief) cell				