Adrenal

SESSION OBJECTIVES:

Use these session objectives to test your knowledge of the important concepts presented in this chapter and as study topics to return to prior to your exams.

1. Describe histology of the normal adrenal gland.
2. Recognize pathology of benign adrenal neoplasms of the adrenal cortex and adrenal medulla.
3. Recognize pathologic features of adrenocortical carcinoma.
4. Identify histologic features of diseases that cause adrenal insufficiency.

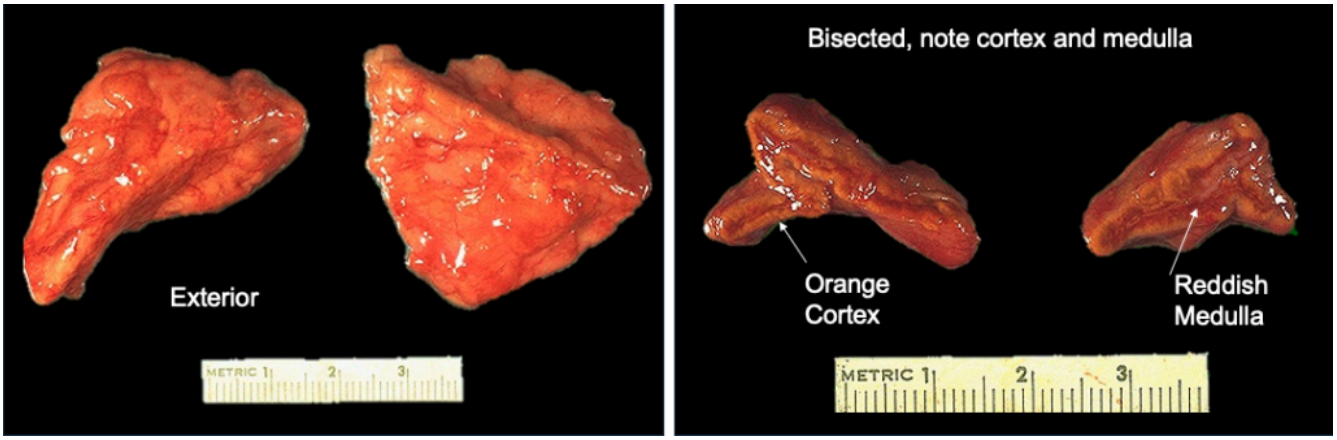
OPTIONAL PRE-CLASS MATERIALS FOR THIS SESSION:

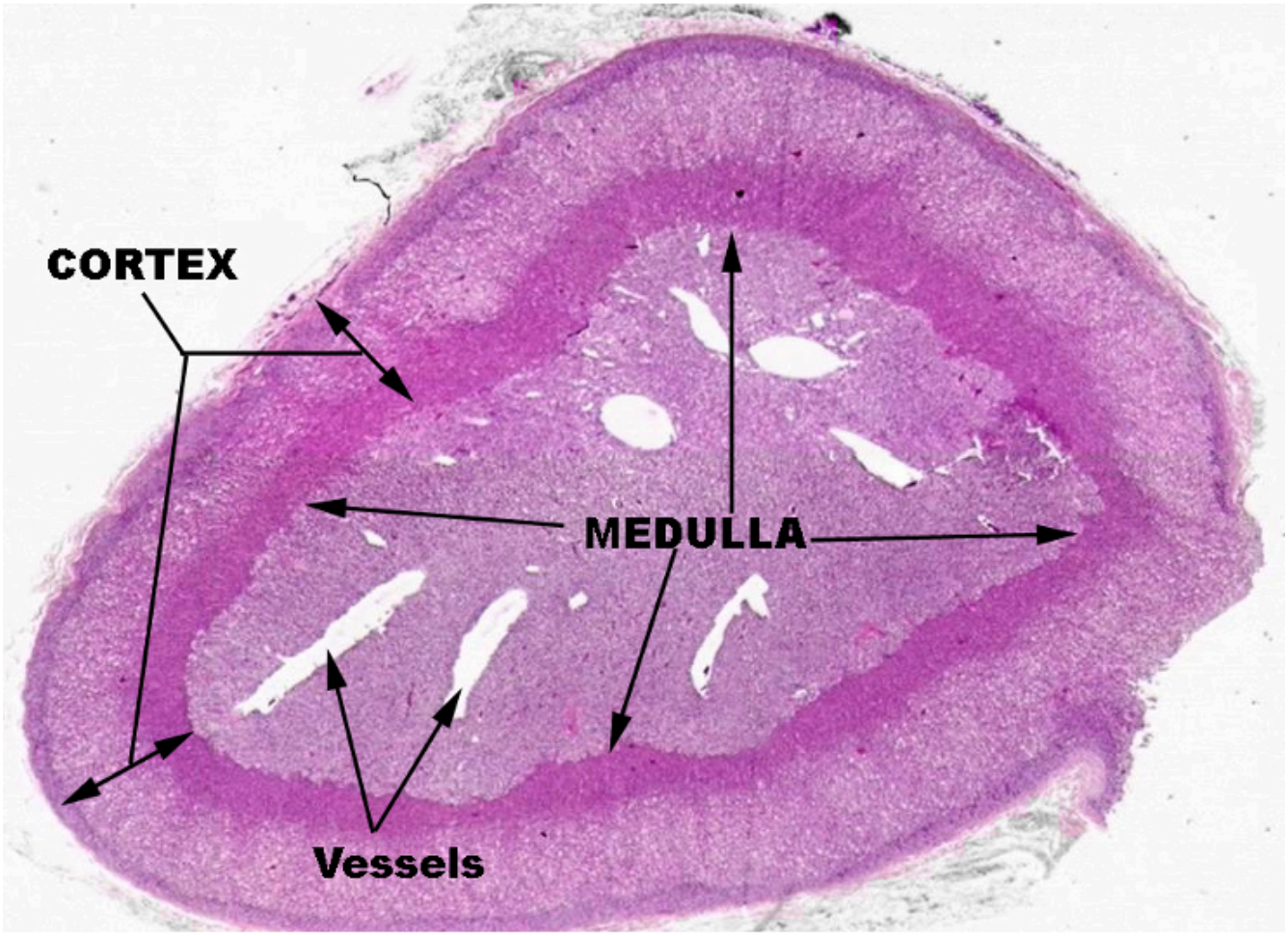
- Skim the **section titles**, **bolded terms,** and **image captions** from Robbin's & Kumar 11th edition, Chapter 18 to fill in any knowledge gaps you need.
- In class exercise: PathPresenter

OVERVIEW:

The adrenal glands are small, triangular organs located above the kidneys. They are vital for producing hormones that regulate metabolism, blood pressure, and immune and stress responses. Each adrenal gland consists of two main parts: the **cortex** (the outer layer) and the **medulla** (the inner layer).

- **Cortex**: Responsible for producing **aldosterone**, **cortisol**, and **androgens**.
- **Medulla**: Produces **epinephrine** and **norepinephrine**, hormones involved in the body's fight-or-flight response.



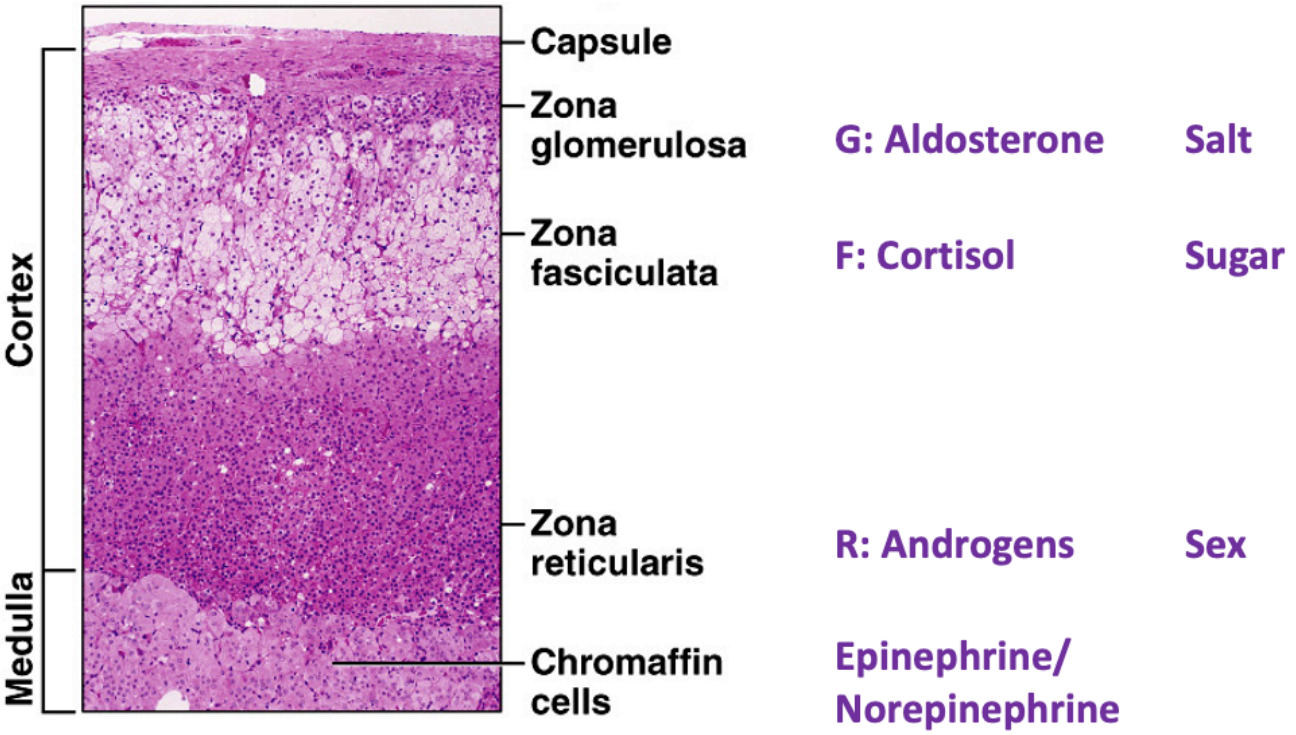


NORMAL HISTOLOGY OF THE ADRENAL GLAND:

The **adrenal cortex** has three distinct zones, each responsible for producing different hormones:

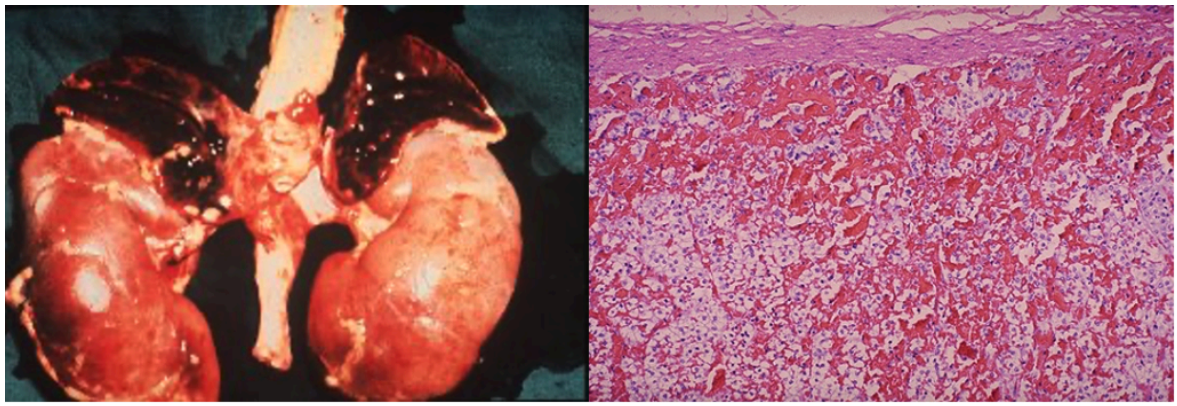
- **Zona Glomerulosa**: Produces aldosterone, which helps control blood pressure by regulating salt and water balance.
- **Zona Fasciculata**: Produces cortisol, a key hormone in the stress response and glucose metabolism.
- **Zona Reticularis**: Produces androgens, involved in the development of secondary sexual characteristics.

The **adrenal medulla** contains chromaffin cells, which release catecholamines (epinephrine and norepinephrine) into the bloodstream, aiding in the body's immediate response to stress.



NON-NEOPLASTIC PATHOLOGY OF THE ADRENAL GLAND:

- **Adrenal Insufficiency**
  - **Acute**: Characterized by sudden hormone deficiency, commonly caused by adrenal hemorrhage, as seen in ***Waterhouse-Friderichsen Syndrome*** (below).



  - **Chronic**: Known as ***Addison's Disease***, often caused by autoimmune destruction, infections like tuberculosis, or metastatic cancer. It results in a gradual decline in adrenal hormone production, leading to symptoms like fatigue, weight loss, and low blood pressure.

- **Cushing Syndrome** results from an excess of **glucocorticoids** (usually cortisol). This condition can be caused by:
  - An **adrenal adenoma** (a benign tumor)

- **Cushing's disease** (ACTH-producing pituitary adenoma)
- Or, ectopic ACTH production (lung or other non-endocrine cancers)

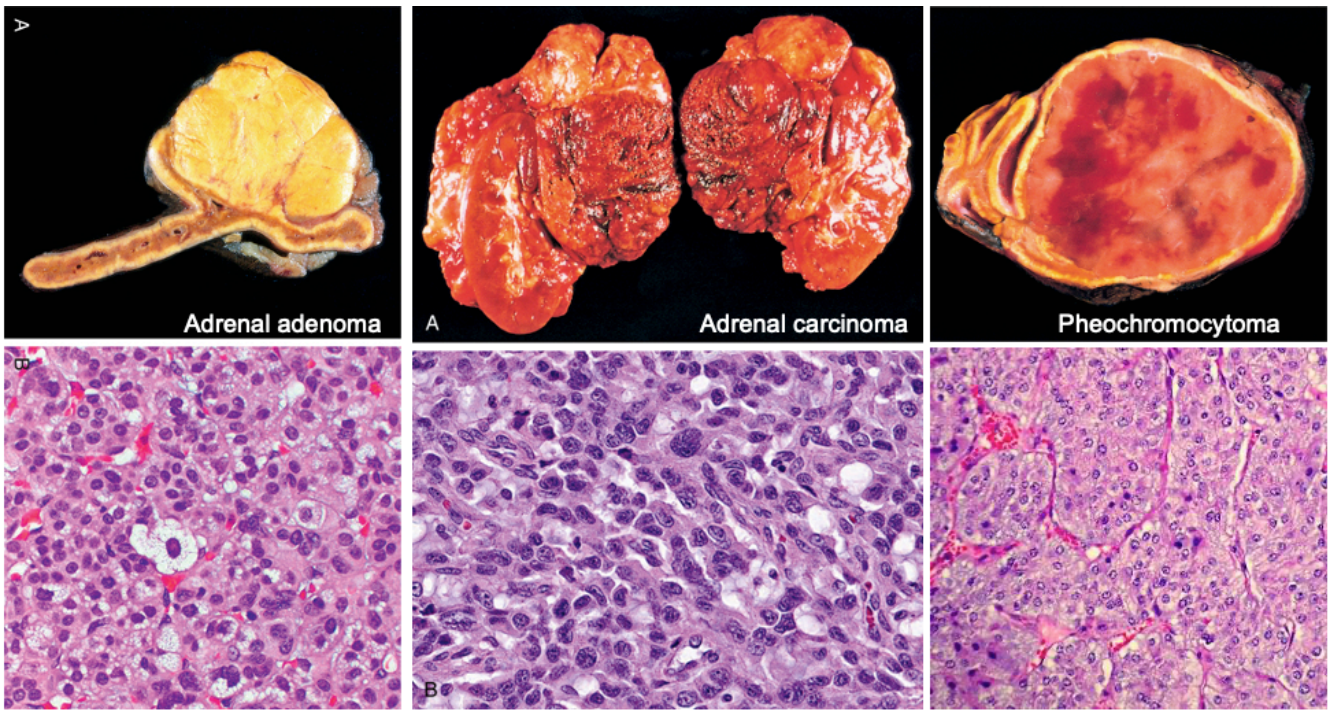
- **Primary Hyperaldosteronism (Conn Syndrome)**
  - Characterized by overproduction of **aldosterone**, leading to high blood pressure and low potassium levels. Most cases are caused by an adrenal adenoma or bilateral adrenal hyperplasia.

NEOPLASTIC PATHOLOGY OF THE ADRENAL GLAND:

- **Adrenal Adenomas**
  - These are benign, well-circumscribed tumors that arise in the adrenal cortex (left images below). While many adenomas are non-functional, some can lead to excess hormone production, resulting in syndromes like **Cushing's syndrome** or **Conn's syndrome**.

- **Adrenocortical Carcinoma**
  - A rare and aggressive cancer that may cause hormone excess (e.g., cortisol, aldosterone) or present as a large, destructive mass. Histologically, these tumors often show **pleomorphic cells**, necrosis, and hemorrhage (center images below).

- **Pheochromocytoma**
  - A tumor of the adrenal medulla that secretes catecholamines, leading to episodic hypertension, headaches, and palpitations.
    - Pheochromocytomas exhibit a characteristic *zellballen* pattern, with polygonal tumor cells arranged in nests, supported by a vascular stroma, showing granular cytoplasm, round nuclei with "salt and pepper" chromatin (images on the right).
  - Known for the **rule of 10s** (10% malignant, 10% bilateral, 10% extra-adrenal), pheochromocytomas may be sporadic or linked to familial syndromes, including:
    - **RET** (associated with **MEN 2A/2B**)
    - **VHL** (linked to **von Hippel-Lindau syndrome**)
    - And **SDH mutations** (in familial pheochromocytomas)



Modified from: Robbins (11th ed) 18-36, 18-37, 18-38

NOTE: The adrenal glands are a common site for metastatic cancers, most often from lung cancer, but also from breast cancer, kidney cancer, and melanoma. These metastatic tumors frequently replace large portions of adrenal tissue, and while they may be asymptomatic, they can sometimes cause adrenal insufficiency if both glands are involved.

This Chapter's PDF

LINK

- Note: The interactive features of this chapter are not reproducible in this PDF format.