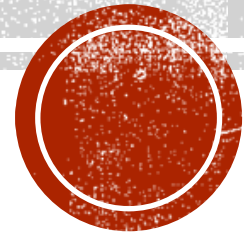


ENDOCRINOLOGY

PAPER- CC 12, 5TH SEMESTER



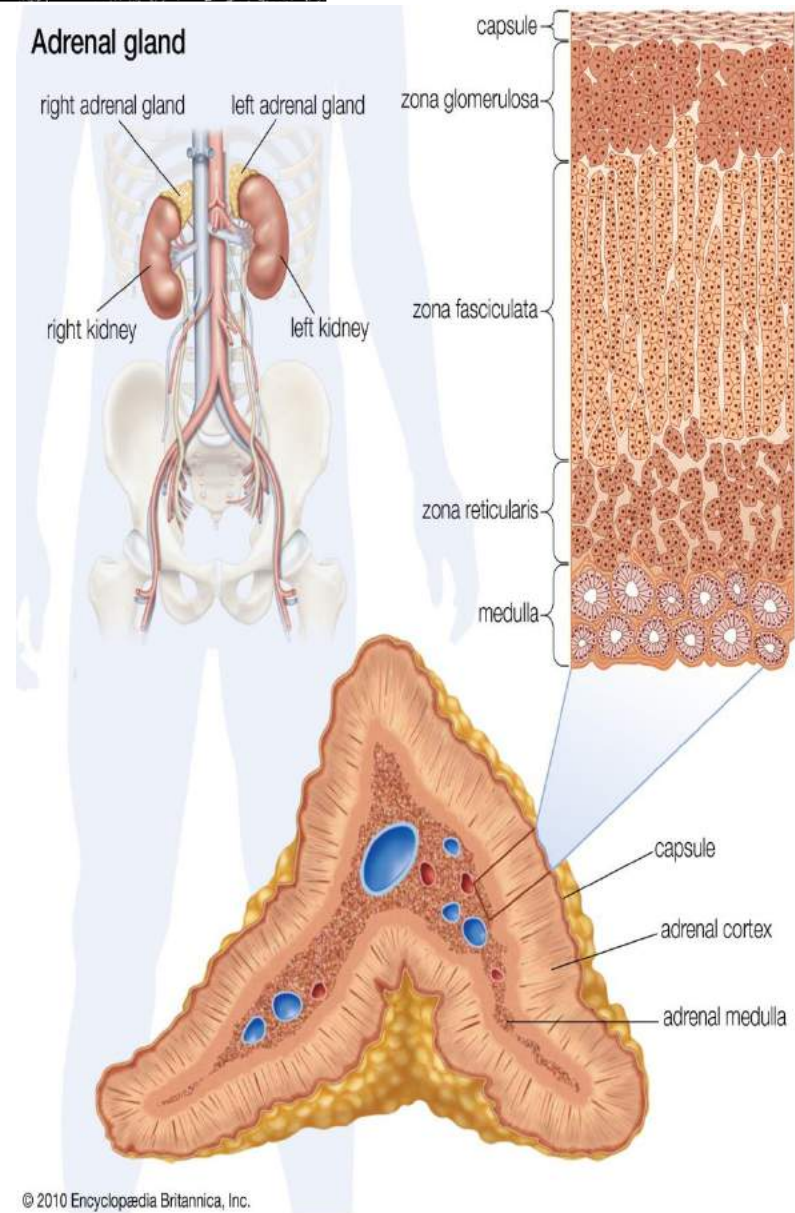
ADRENAL GLAND

- Adrenal glands, also known as suprarenal glands, are small, triangular-shaped glands located on top of both kidneys.
- Adrenal glands produce hormones that help regulate your metabolism, immune system, blood pressure, response to stress and other essential functions.
- Adrenal glands are composed of two parts — the cortex and the medulla — which are each responsible for producing different hormones.
- When adrenal glands don't produce enough hormones, this can lead to adrenal insufficiency (Addison's disease).
- Adrenal glands may develop nodules that can be benign or malignant, which can potentially produce excessive amounts of certain hormones leading to various health issues.

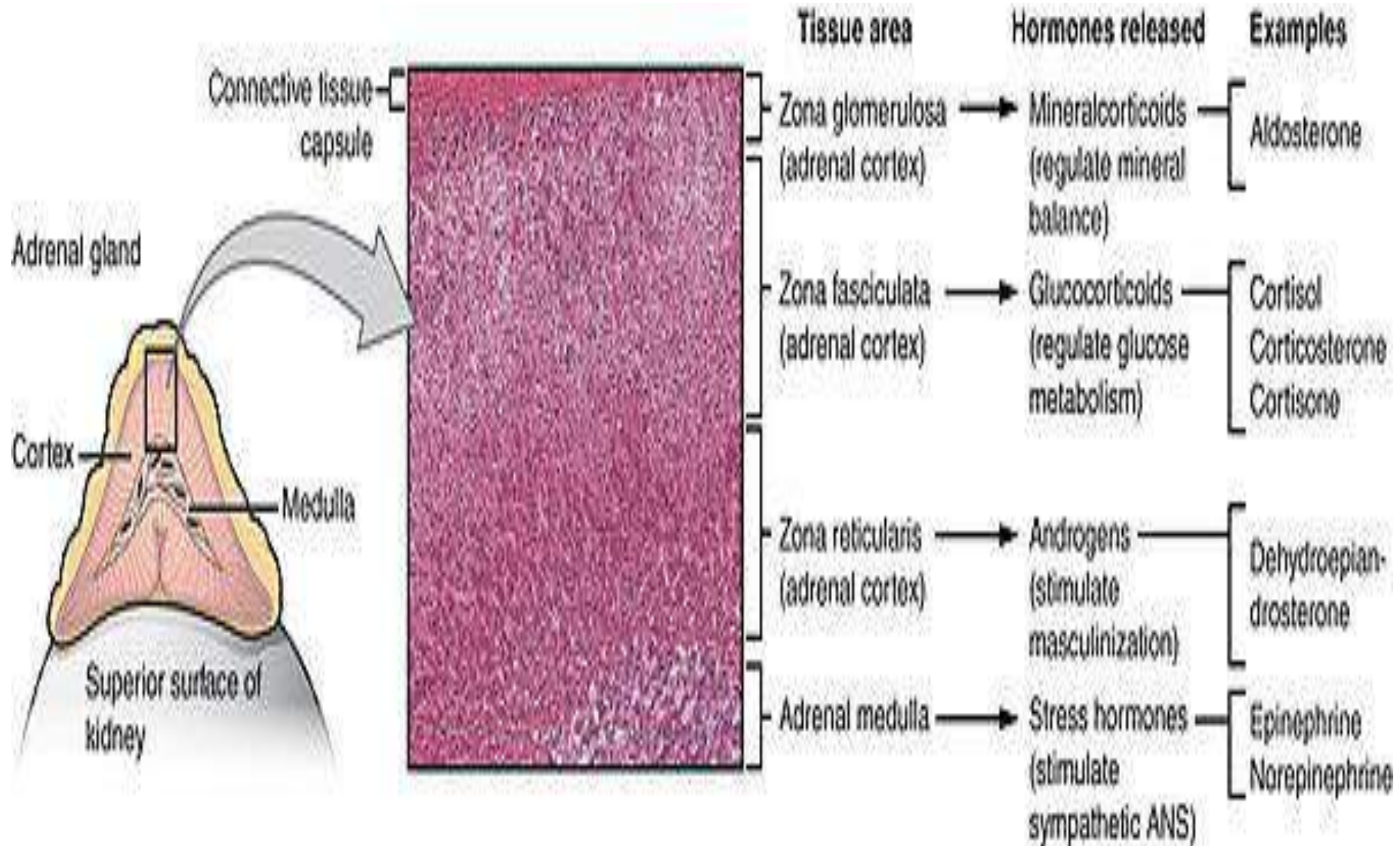


ANATOMY OF ADRENAL GLAND

- An adrenal gland is made of two main parts:
- The **adrenal cortex** is the outer region and also the largest part of an adrenal gland. It is divided into three separate zones: zona glomerulosa, zona fasciculata and zona reticularis. Each zone is responsible for producing specific hormones.
- The **adrenal medulla** is located inside the adrenal cortex in the center of an adrenal gland. It produces “stress hormones,” including adrenaline.

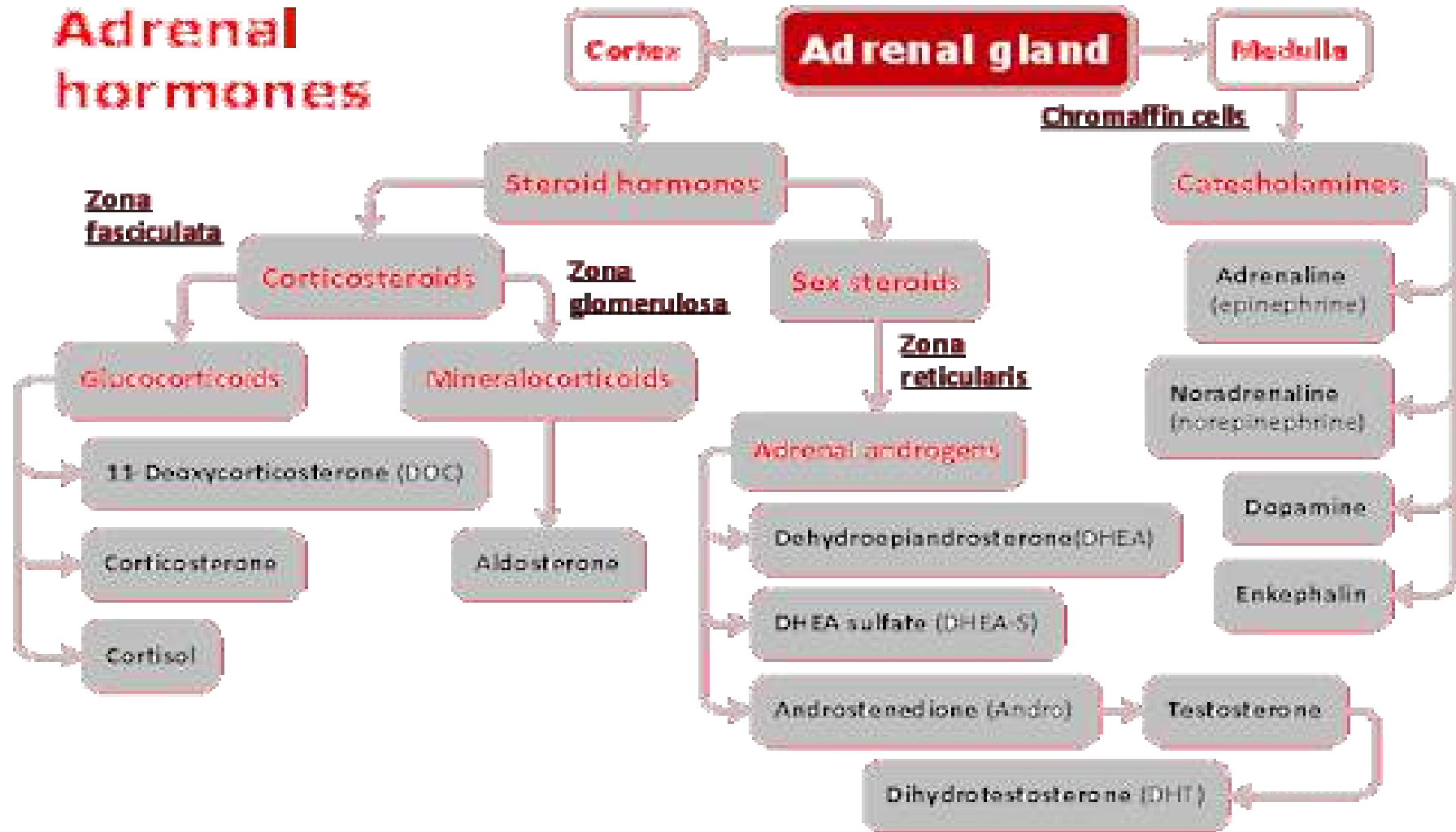


HORMONES OF THE ADRENAL GLAND

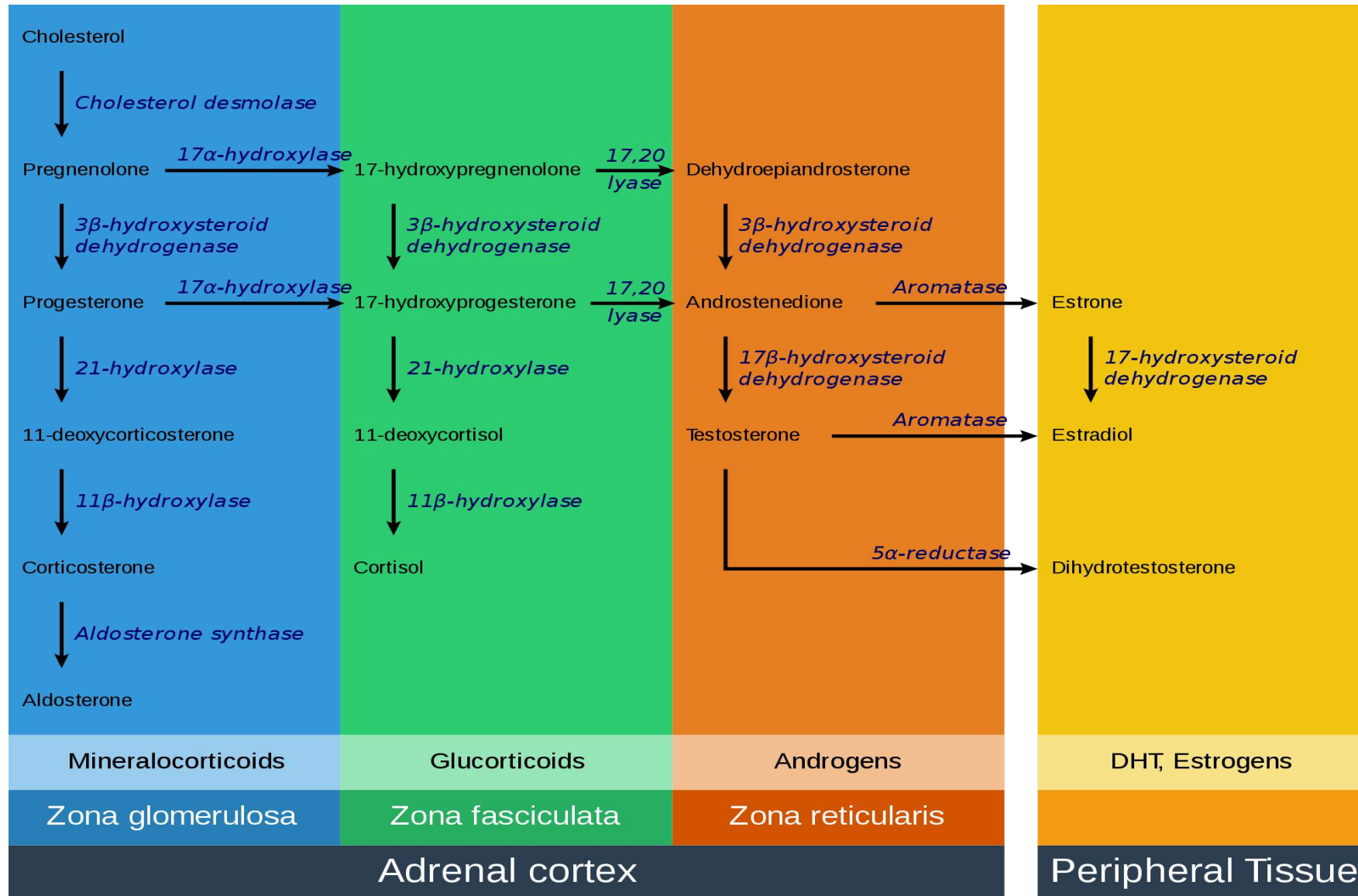


HORMONES OF THE ADRENAL GLAND

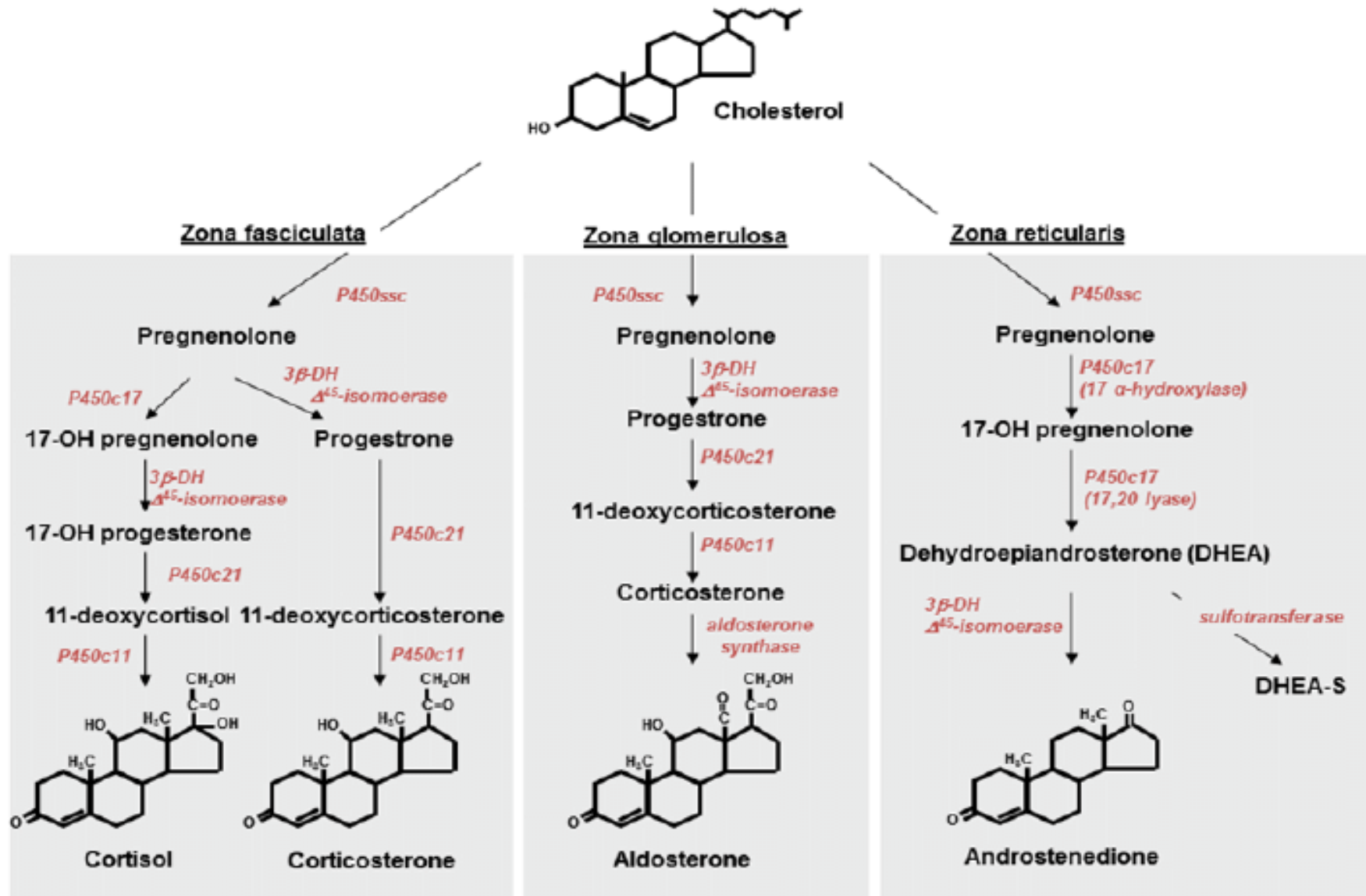
Adrenal hormones



SYNTHESIS OF ADRENAL CORTEX HORMONES



SYNTHESIS OF ADRENAL CORTEX HORMONES



GLUCOCORTICOIDS - CORTISOL

- Cortisol is a glucocorticoid hormone produced by the zona fasciculata that plays several important roles in the body. It helps control the body's use of fats, proteins and carbohydrates; suppresses inflammation; regulates blood pressure; increases blood sugar; and can also decrease bone formation.
- This hormone also controls the sleep/wake cycle. It is released during times of stress to help your body get an energy boost and better handle an emergency situation.

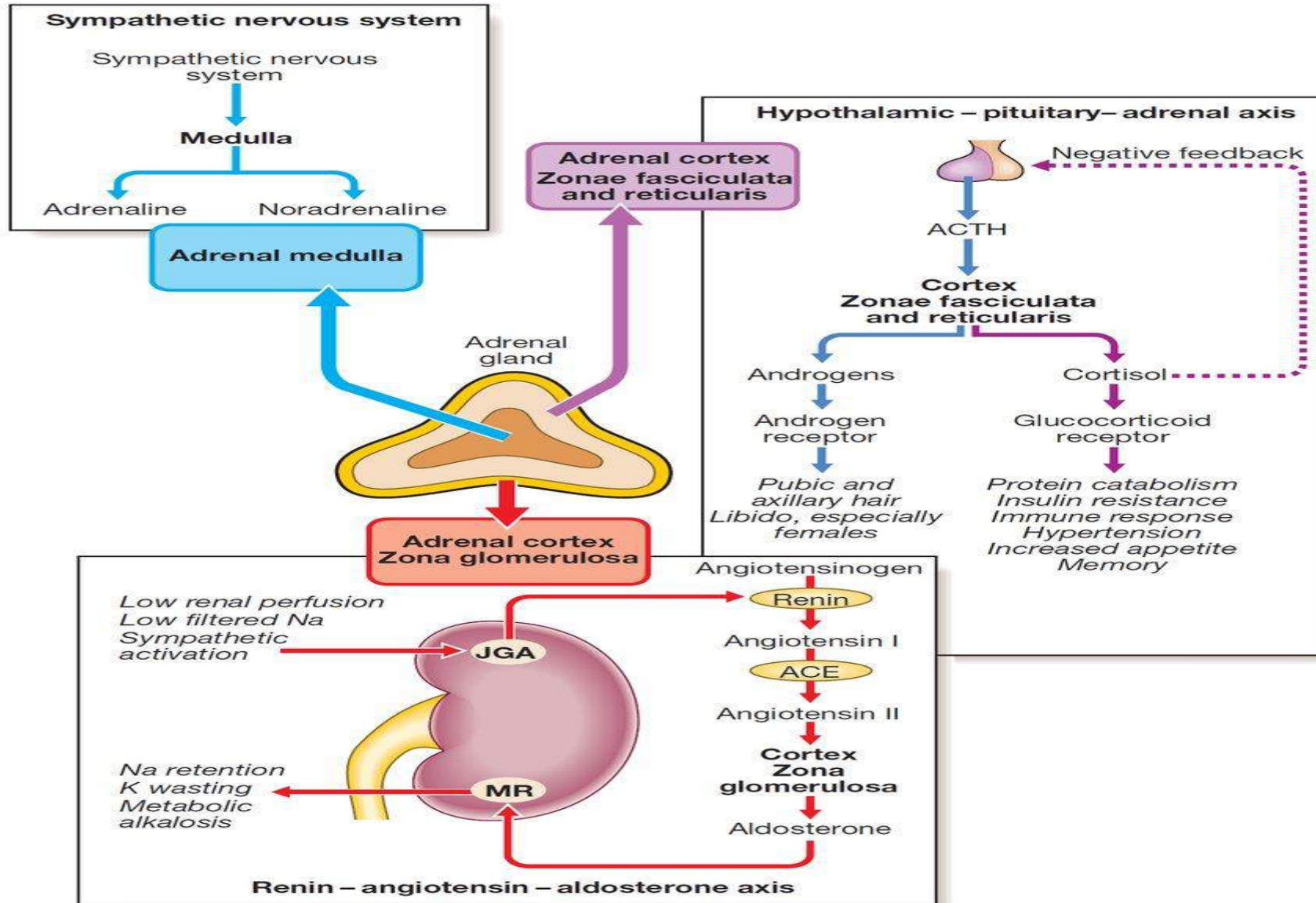


HOW ADRENAL GLANDS WORK TO PRODUCE CORTISOL

- Adrenal glands produce hormones in response to signals from the **pituitary gland** in the brain, which reacts to signaling from the hypothalamus, also located in the brain. This is referred to as the hypothalamic pituitary adrenal axis. As an example, for the adrenal gland to produce cortisol, the following occurs:
- The hypothalamus produces corticotropin-releasing hormone (CRH) that stimulates the pituitary gland to secrete adrenocorticotropin hormone (ACTH).
- ACTH then stimulates the adrenal glands to make and release cortisol hormones into the blood.
- Normally, both the hypothalamus and the pituitary gland can sense whether the blood has the appropriate amount of cortisol circulating. If there is too much or too little cortisol, these glands respectively change the amount of CRH and ACTH that gets released. This is referred to as a negative feedback loop.
- Excess cortisol production can occur from nodules in the adrenal gland or excess production of ACTH from a tumor in the pituitary gland or other source.



REGULATION OF ADRENAL HORMONES

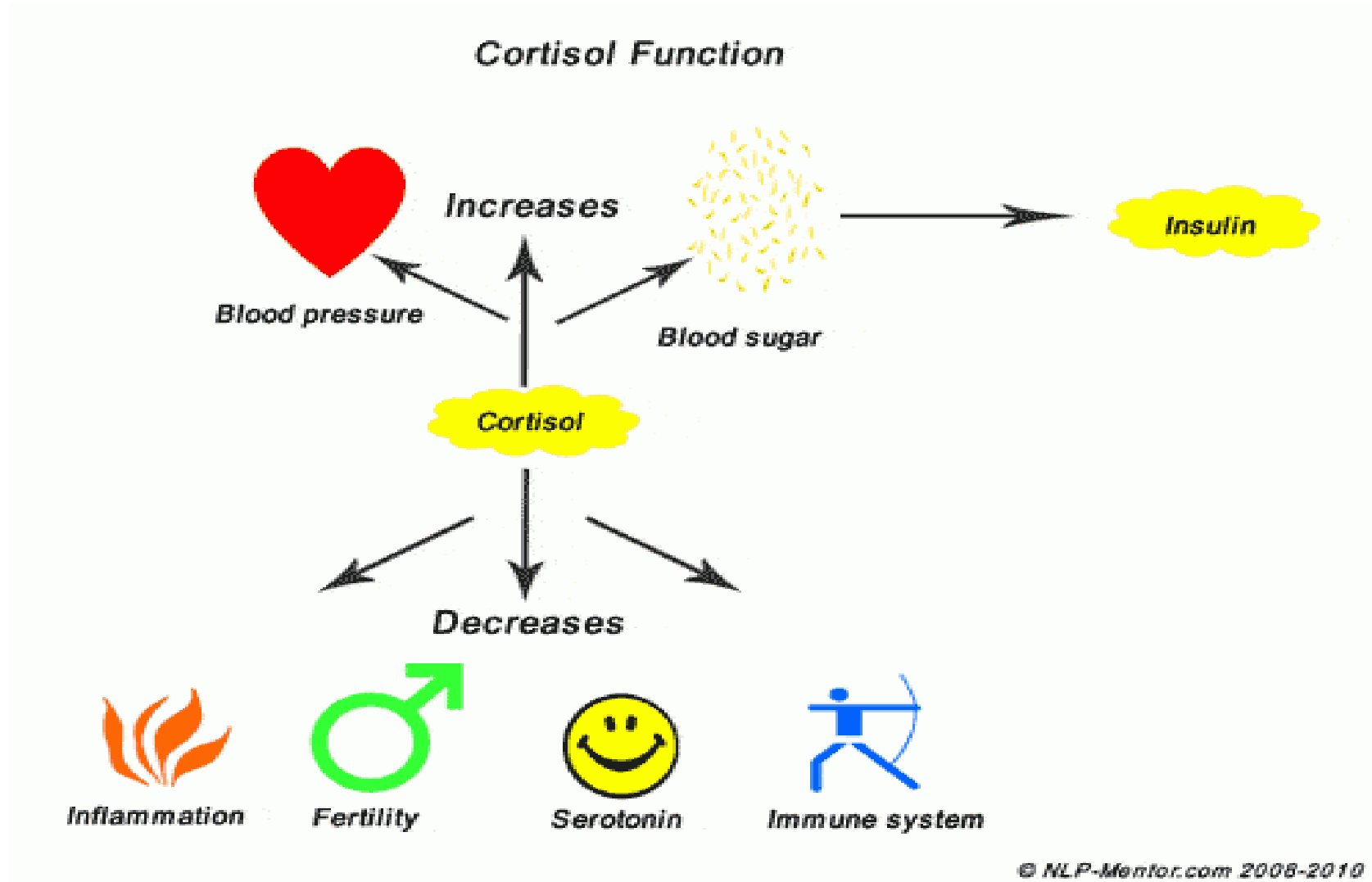


Structure and function of the adrenal glands. (ACE = angiotensin-converting enzyme; JGA = juxtaglomerular apparatus; MR = mineralocorticoid receptor)

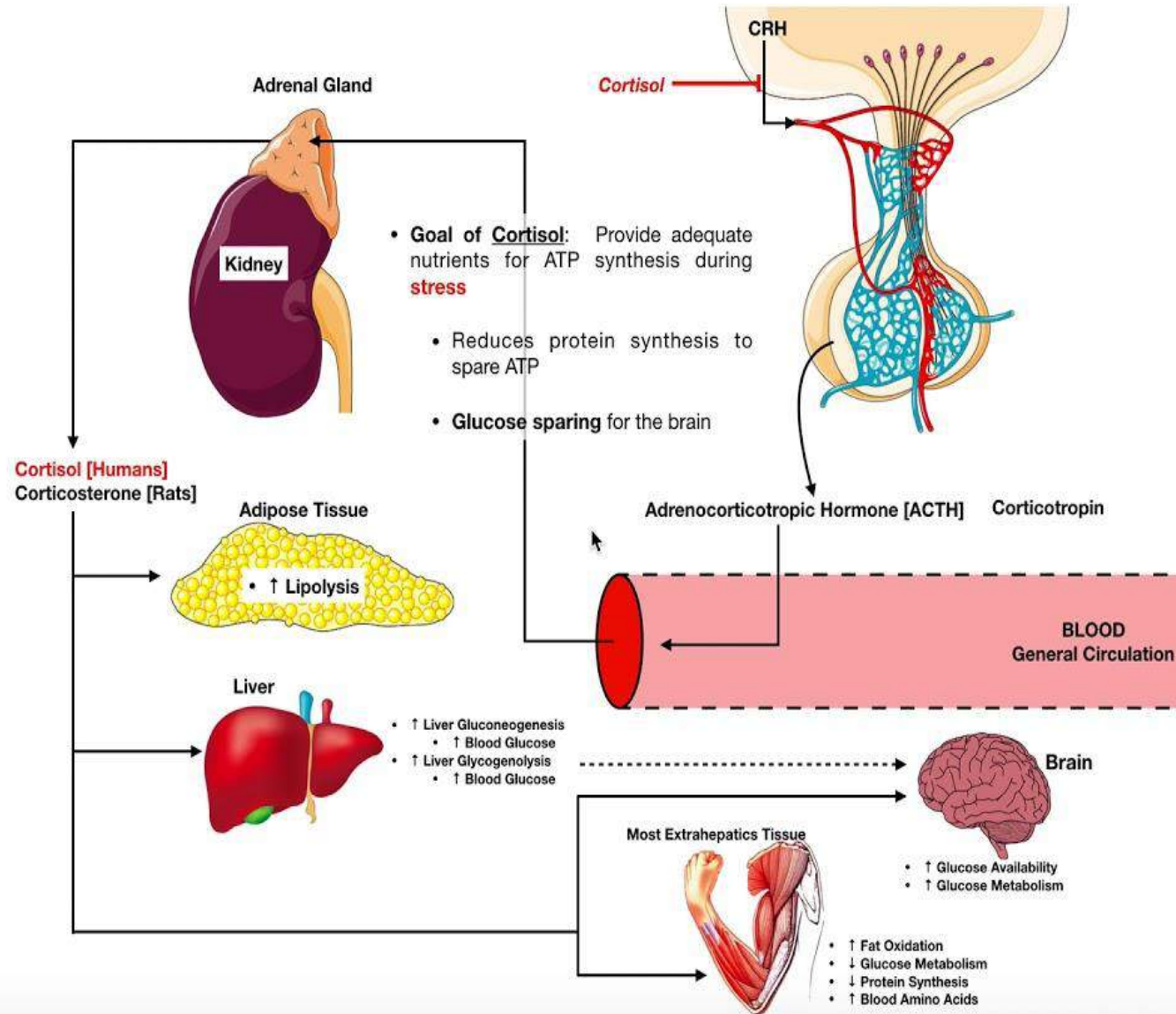
Source : Davidsons Essentials of Medicine, 2e



PHYSIOLOGICAL FUNCTIONS OF CORTISOL



PHYSIOLOGICAL FUNCTIONS OF CORTISOL



CORTISOL

Protein Metabolism

Protein degradation

(connective tissue, smooth muscle, resting skeletal muscle)

Anti-anabolic action

(connective and muscle tissues)

Protein synthesis

(liver)

Pool of free amino acids

Glucose-Alanine Cycle

Alanine synthesis (skeletal muscle)

Gluconeogenesis

Alanine desamination (liver)

Glucose production (liver)

Urea synthesis (liver)

Inhibition of Inflammatory Processes

Immunity and Immuno Activities

Involution of lymphoid tissue, decreased output of

T-cells and antibodies

Permissive Action

Conditions for cAMP accumulation



Functions of cortisol

1) Protein metabolism:

- It inhibits amino acid uptake and protein synthesis in **extrahepatic** tissues.
- **Catabolic** in muscle, skin and bone.
- **Excess cortisol → severe muscle wasting.**

2) CHO metabolism: ↑ **Blood glucose** level by:

- ↓ Tissue uptake of glucose.
- ↓ Conversion of glucose to glucose-6-phosphate (**anti-insulin action**).
- ↑ gluconeogenesis in liver.
- **Excess cortisol → diabetogenic.**



Functions of cortisol

3) Fat metabolism:

- Mobilization of fat from fat depots to supply energy (**Lipolytic ketogenic**).
- **Excess cortisol → ketosis.**

4) Cardiovascular function:

- Increase myocardial contractility and vasoconstriction due to enhancement of catecholamine effects (***permissive effects of cortisol***).



Functions of cortisol

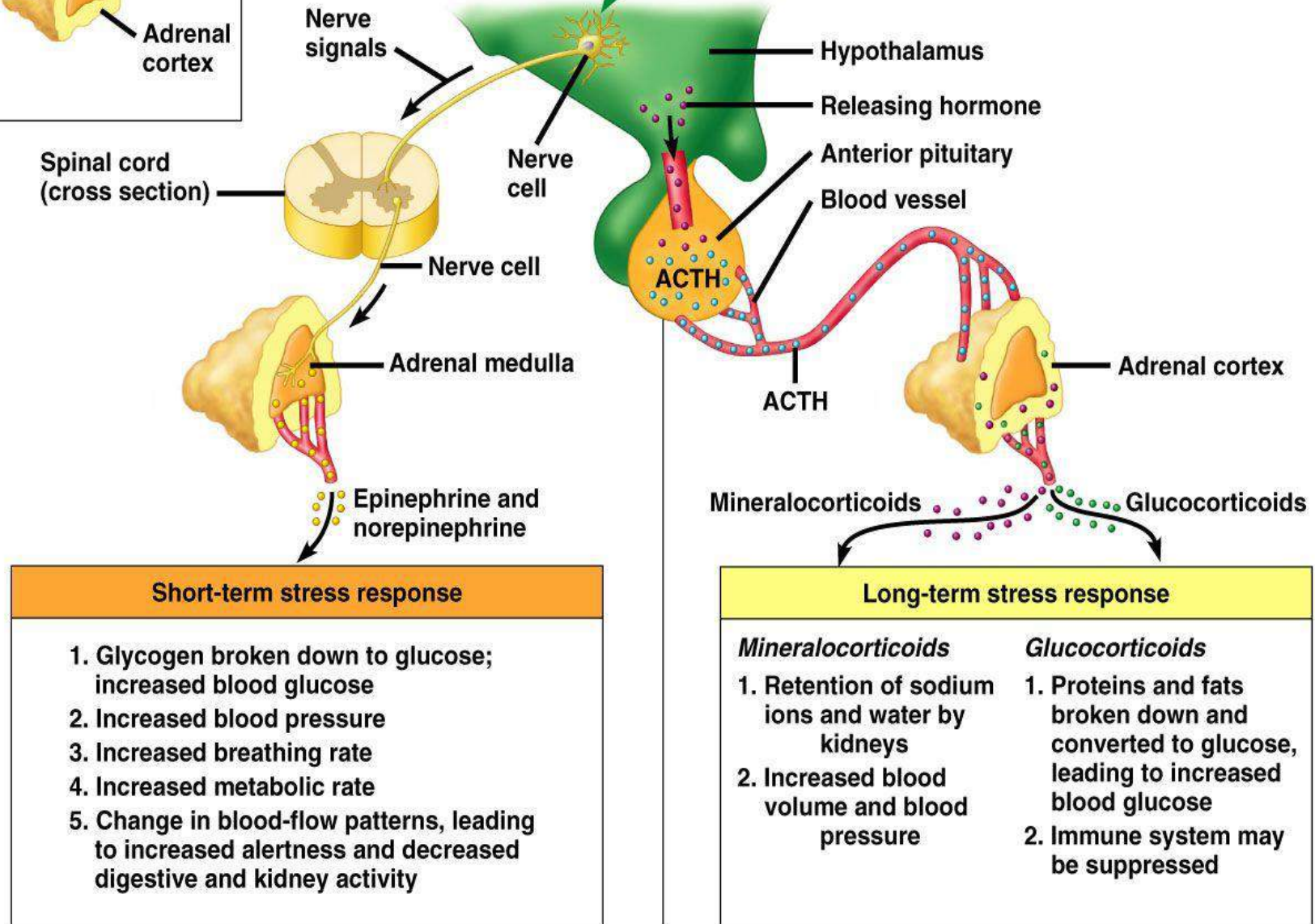
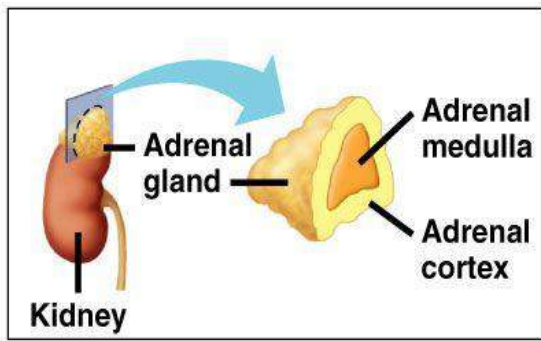
5) Anti-stress:

- Activate energy metabolism.
- In severe physical or mental stress, cortisol plasma conc. remains at a very high level (up to 10 times the normal value) throughout the day.

6) Anti-allergic:

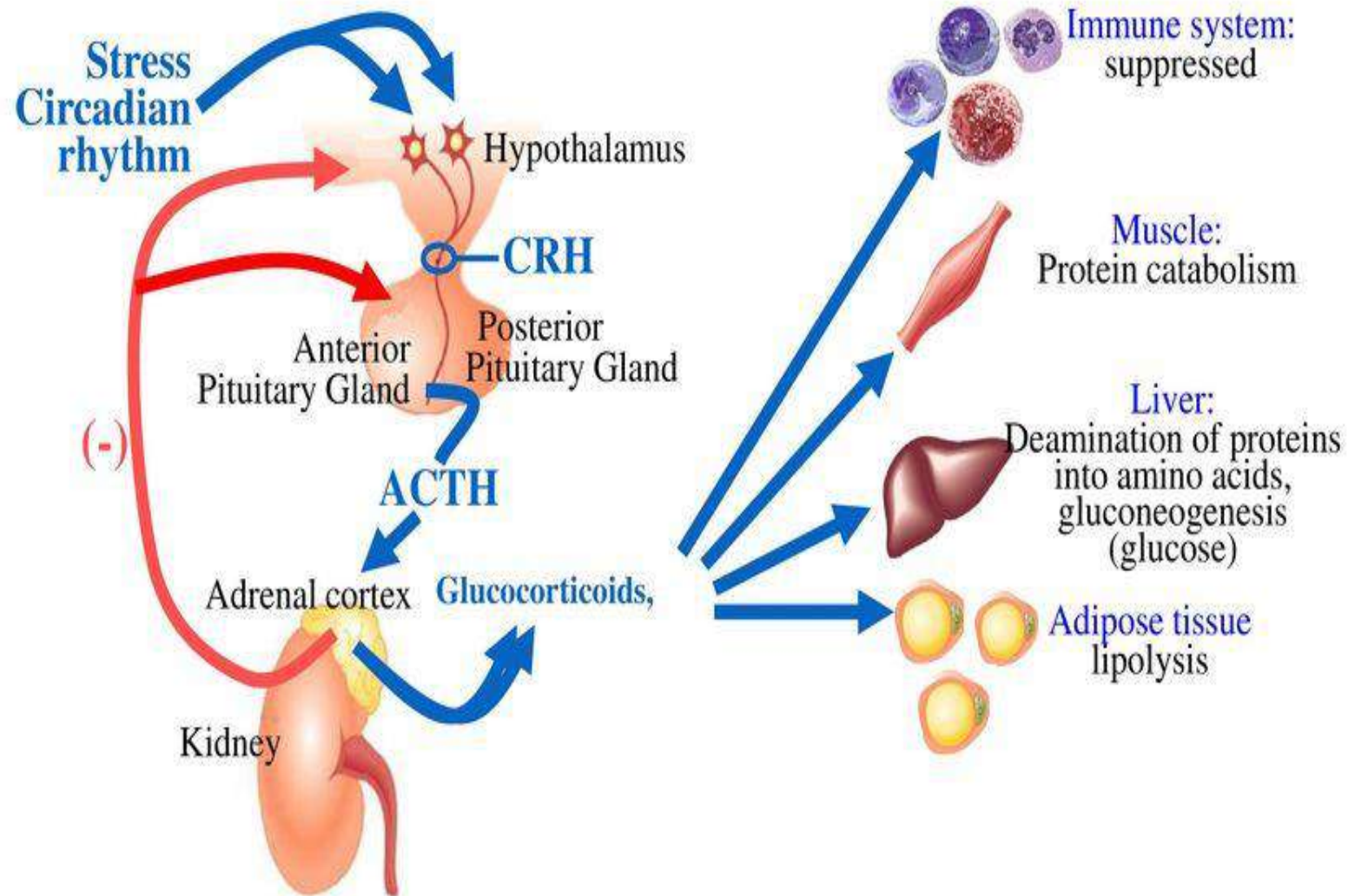
- Cortisol inhibits allergic responses.
- ↓ **Histamine** synthesis in mast cells and basophils
- ↓ **Kinin** synthesis.



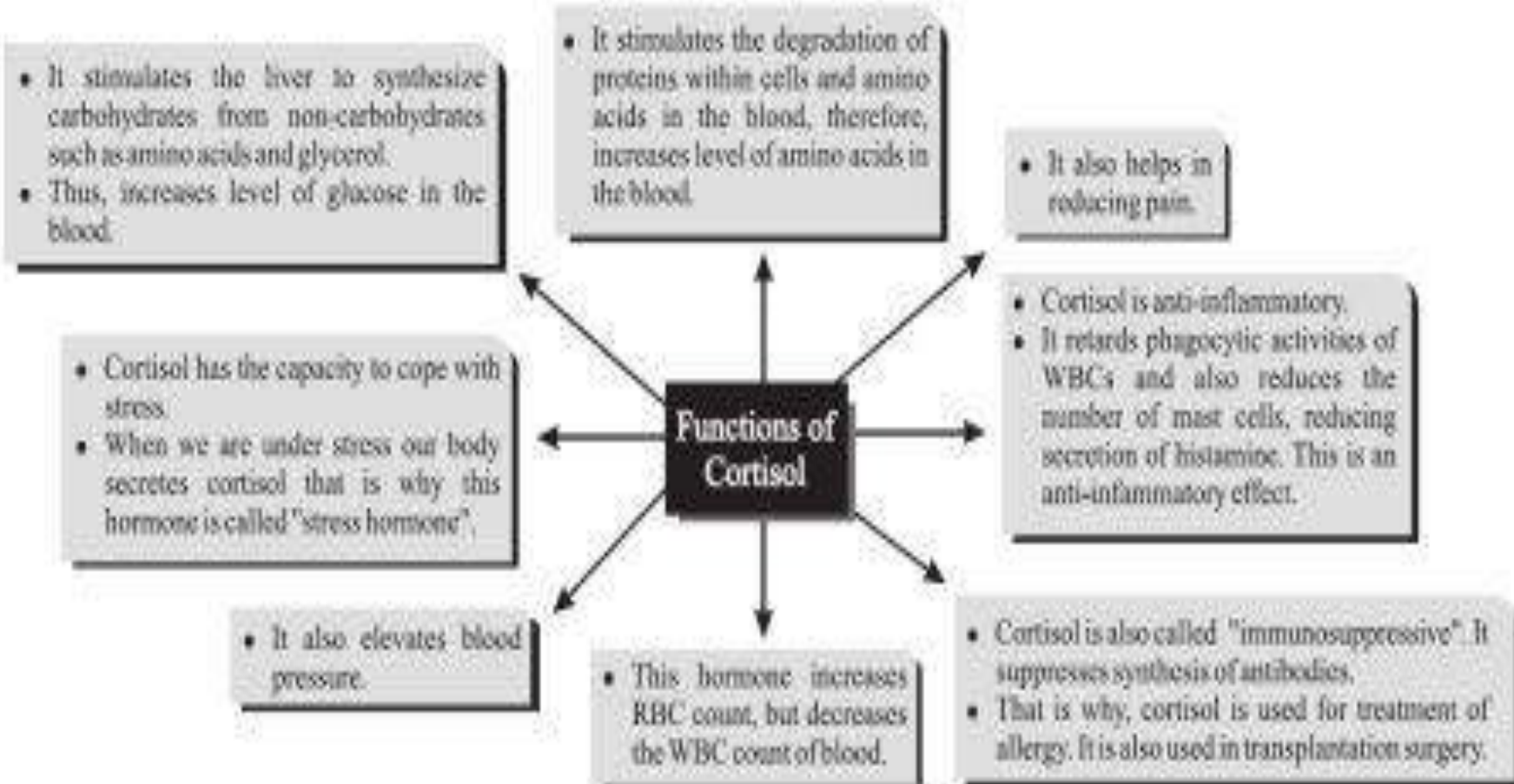


Regulation of adrenal cortex

Hypothalamopituitary adrenal (HPA) axis



Functions of cortisol



Too Much or Too Little?

- **Hypersecretion of cortisol**
 - Cushing's Disease
- **Hyposecretion of cortisol**
 - Addison's Disease
 - Hypopituitarism
 - Acute Adrenal Crisis

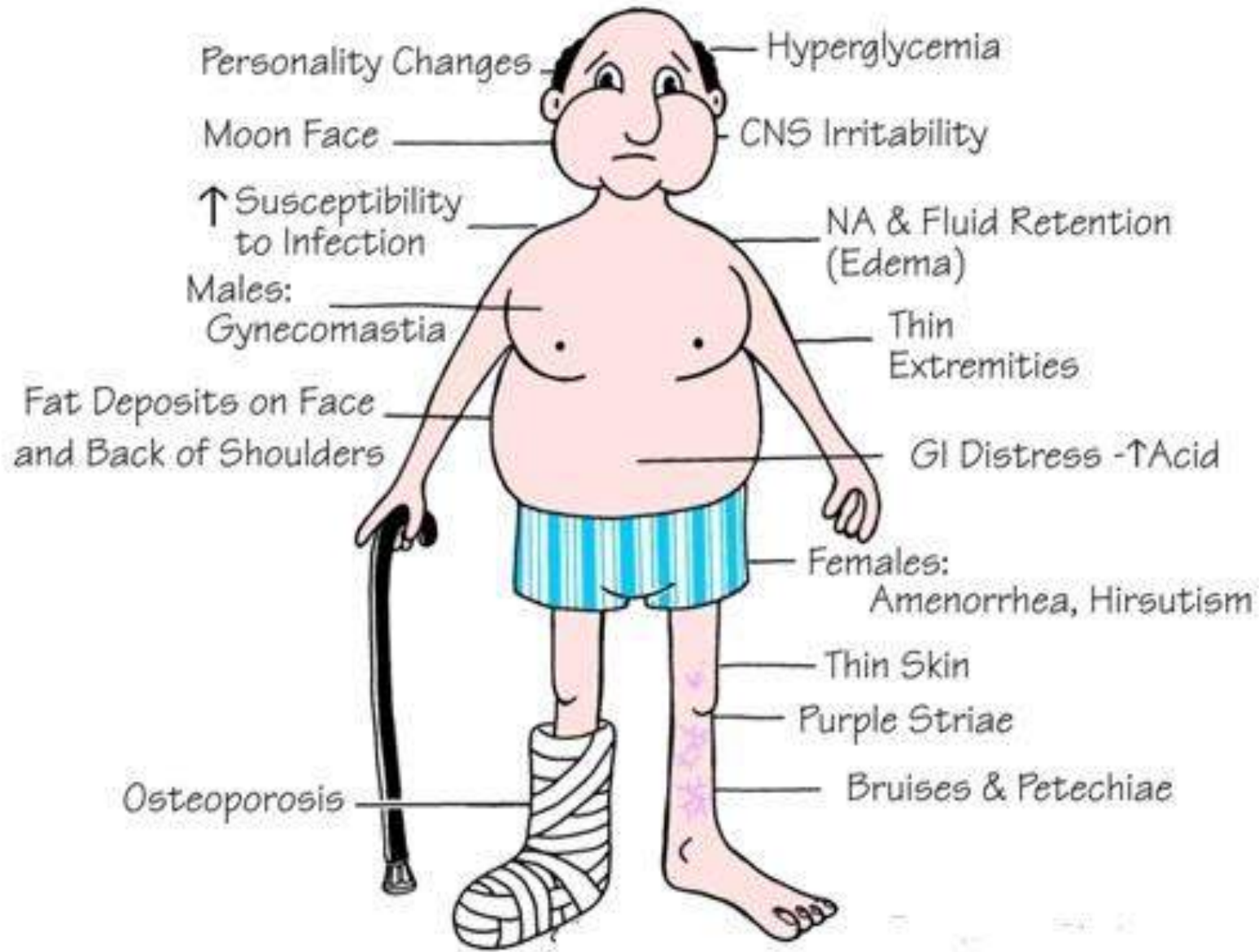


Cushing's syndrome

- **Hypersecretion of cortisol** caused by **endogenous production** of corticosteroids is known as Cushing's syndrome.
- It can be either **ACTH-dependent** or **ACTH-independent** in origin.
- **85 per cent** of ACTH-dependent Cushing's syndrome :
- **Pituitary adenoma** that secretes an excessive amount of ACTH(CUSHING DISEASE)
- **Ectopic ACTH-producing tumours** (small cell lung cancer, foregut carcinoid)
- **CRH-producing tumours** (medullary thyroid carcinoma, neuroendocrine pancreatic tumour)



CUSHING'S SYNDROME





Addison's Disease (Primary Hypoadrenalism)

1. Adrenal Gland

Outer Cortex

Produces Steroids:

- Cortisol
- Aldosterone
- Androgen

2.

DESTRUCTION OF ENTIRE ADRENAL CORTEX

3. Whats causing this...

- 90% - destruction of entire adrenal cortex by organ specific autoantibodies
- Rarer causes - haemorrhage, malignant infiltration, adrenal gland tuberculosis

4. What are the clinical features:

a. Non - Specific Symptoms:

- Lethargy
- Depression
- Anorexia
- Weight Loss

b. What else to look out for:

- Postural Hypotension
- Hyper pigmentation
- + Vitiligo
- Loss of body hair in women

c. Addisonian Crisis:

- Vomiting
- Abdominal pain
- Profound weakness
- Hypoglycaemia
- Hypovolaemic Shock



• Adrenal Gland Disorders



- Hyposecretion of glucocorticoids and aldosterone
- **Chronic adrenocortical insufficiency**
- Majority of cases are autoimmune, in w/c Ab's causes adrenal cortex destruction or blocking binding of ACTH to its receptors.

