DISEASES
OF
THE ADRENAL GLAND
CLINICAL ASPECT

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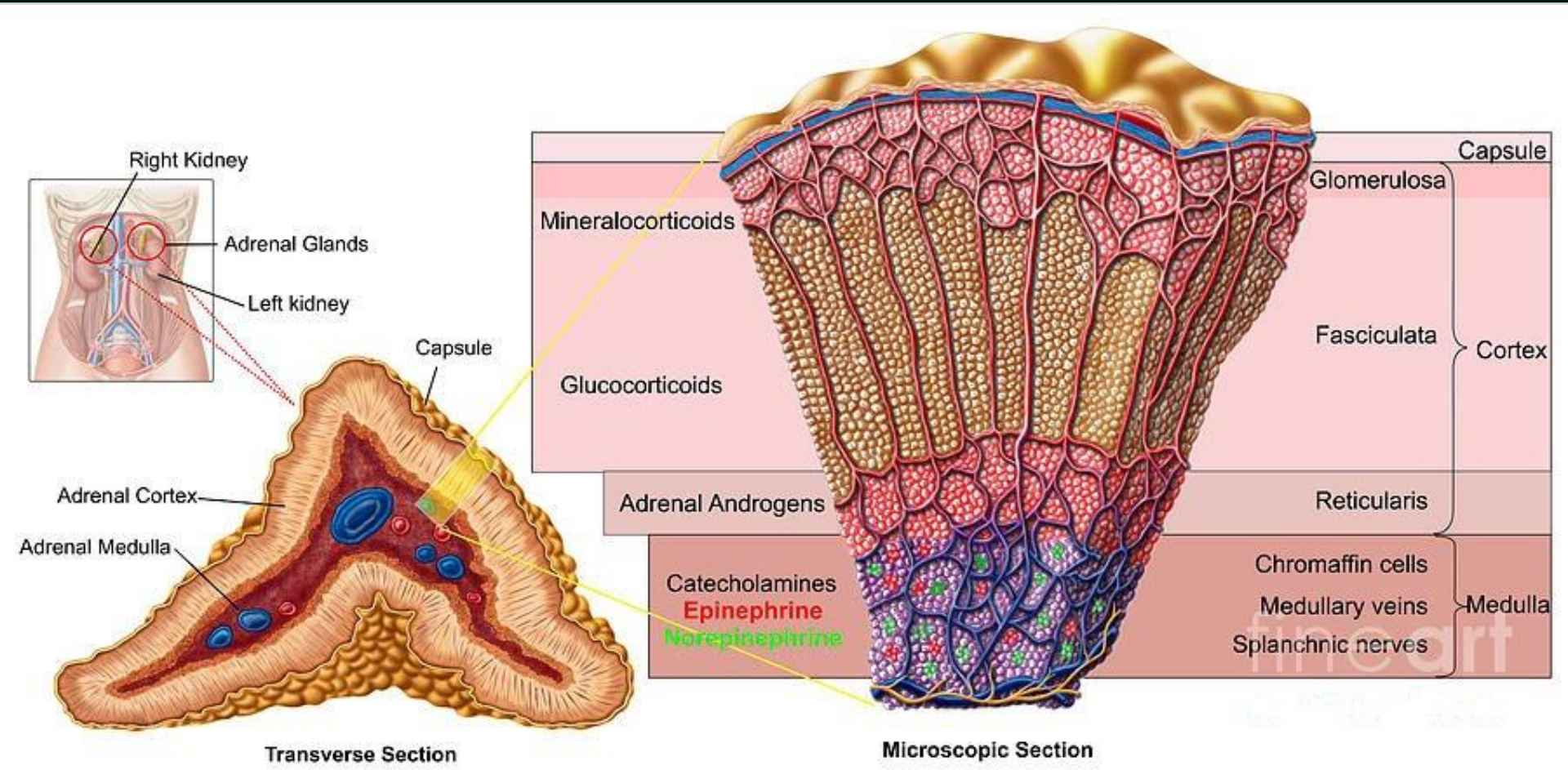
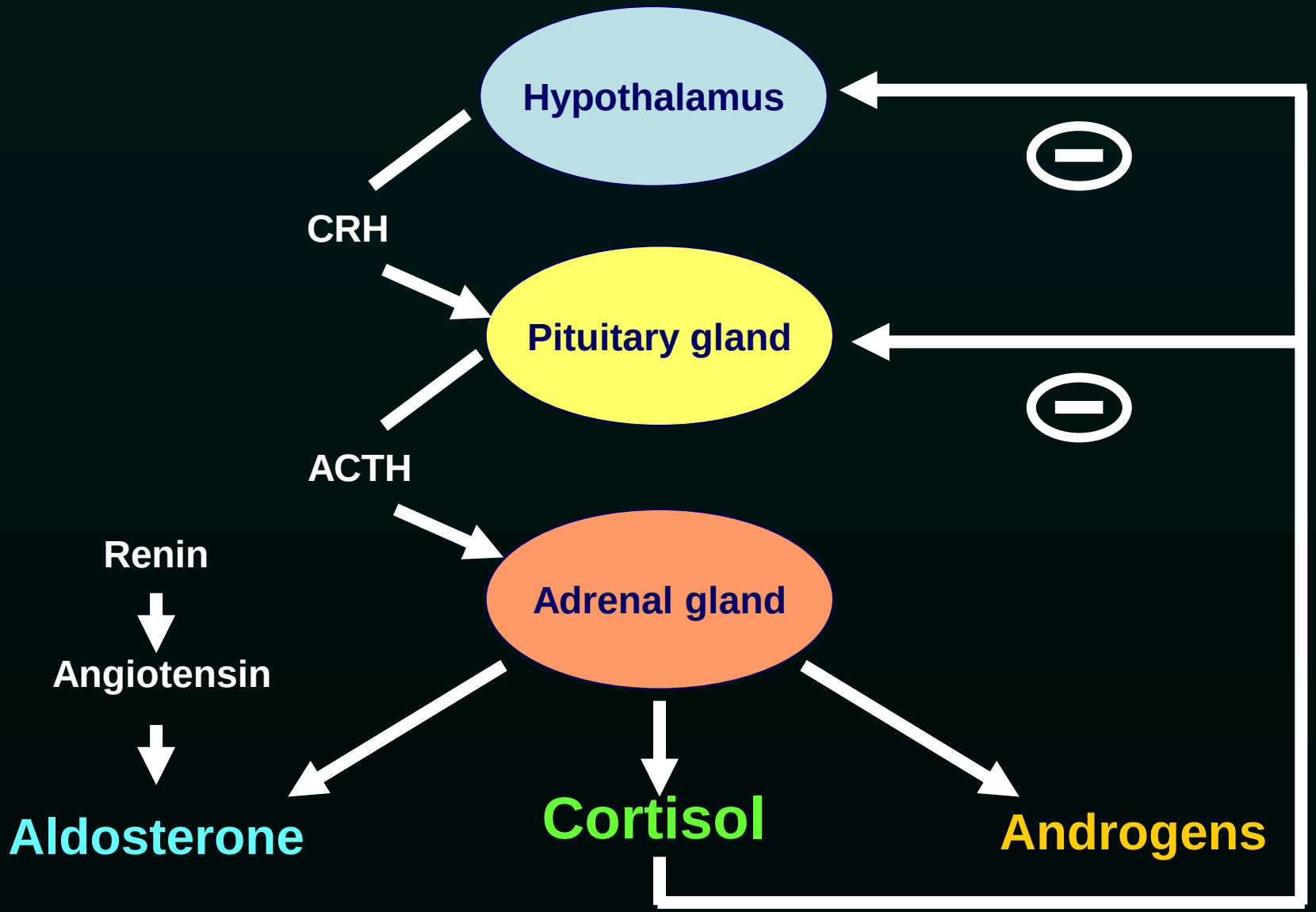
Normal adrenal gland



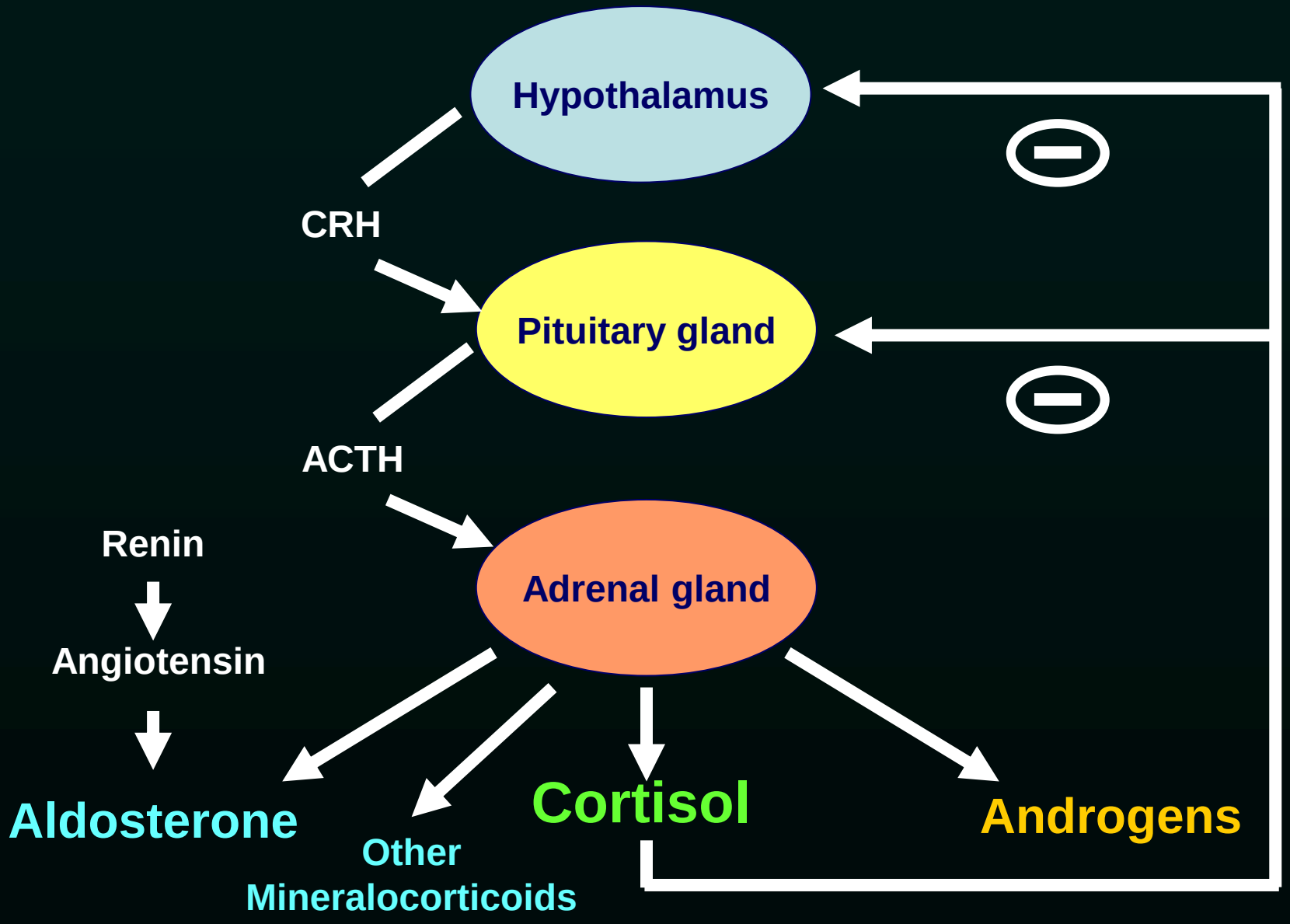
Common adrenal diseases

	Hyperfunction	*Hypofunction*
Cortex	Cushing's syndrome Primary aldosteronism	Adrenal insufficiency
Medulla	Phaeochromocytoma	

Normal hypothalamic-pituitary-adrenal axis



Normal hypothalamic-pituitary-adrenal axis



Cushing's syndrome : Etiology

- Exogenous Cushing's syndrome
- Endogenous Cushing's syndrome

Endogenous Cushing's syndrome : ACTH-dependent

ACTH-secreting pituitary tumor (Cushing's disease)

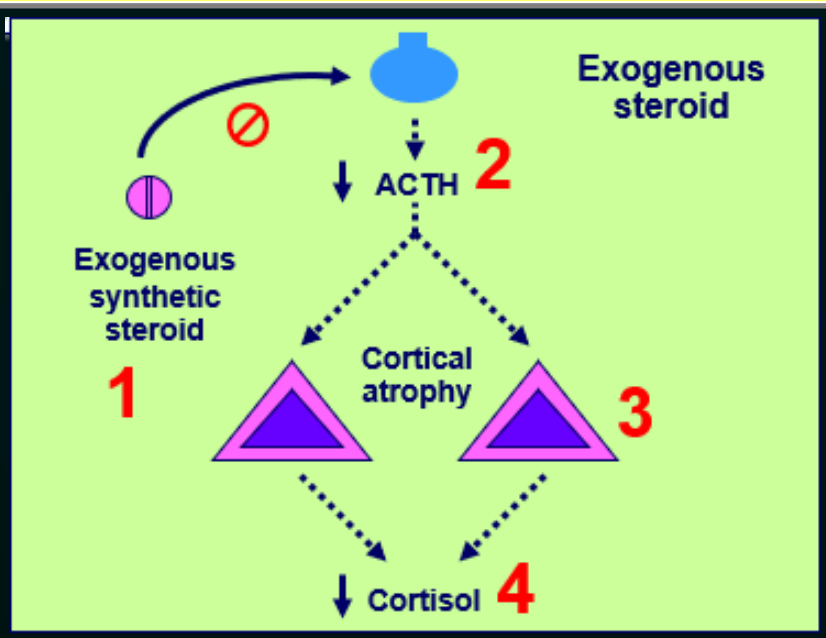
Ectopic ACTH / CRH syndrome

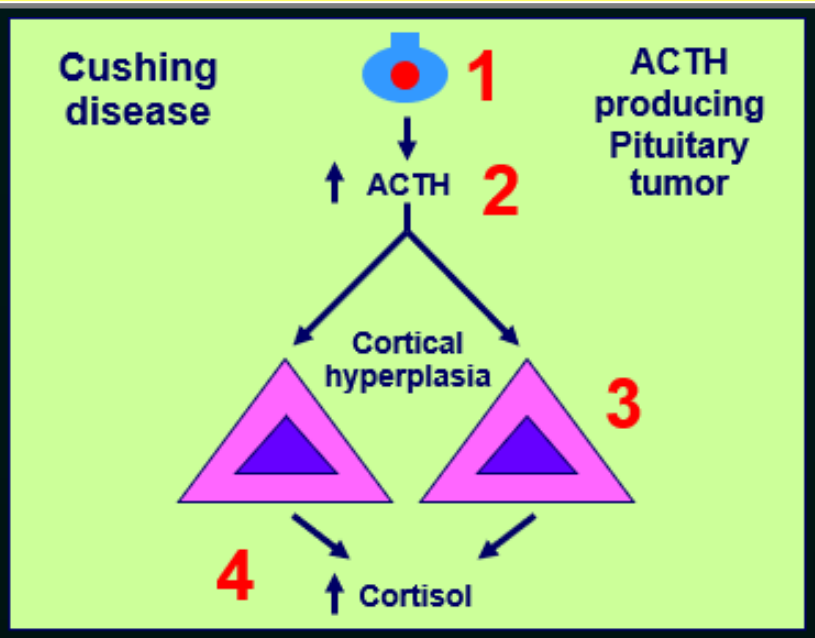
Endogenous Cushing's syndrome : ACTH-independent

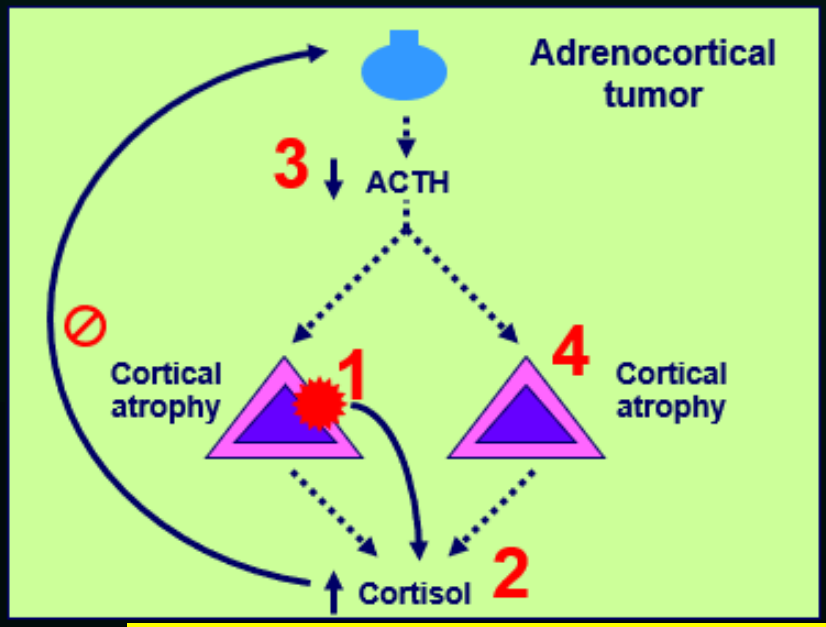
Adrenal adenoma

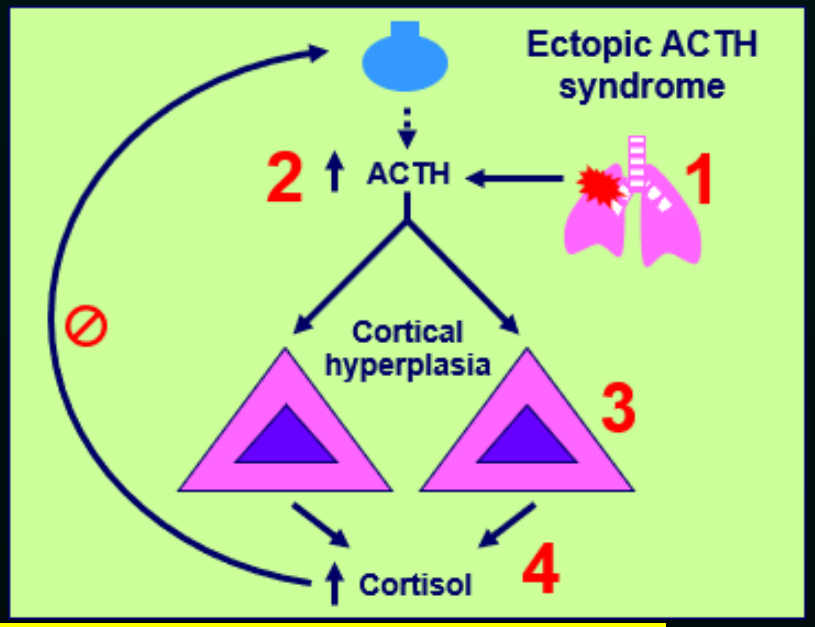
Adrenal carcinoma

Cushing's syndrome: etiologies









Sequence of the events: 1→2→3→4

Causes of ectopic ACTH syndrome

- Bronchogenic (small cell) carcinoma (most common)
- Bronchial carcinoid
- Thymic carcinoid
- Malignant thymoma
- Phaeochromocytoma
- Pancreatic islet carcinoma
- Pancreatic adenocarcinoma
- Oat cell carcinoma of esophagus
- Ovarian carcinoma
- Miscellaneous
- Unknown

Biological actions of cortisol and its disorders

Biological actions

- Glucose metabolism: Maintain BS
- Fat and lipid metabolism

- Protein metabolism

- Mineralocorticoid action
  Maintain vascular tone and BP
  Enhance catecholamine response
- Bone metabolism
- Antiinflammation/ Immunosupp.
- Decr. L, Eo, Incr. PMN and RBC

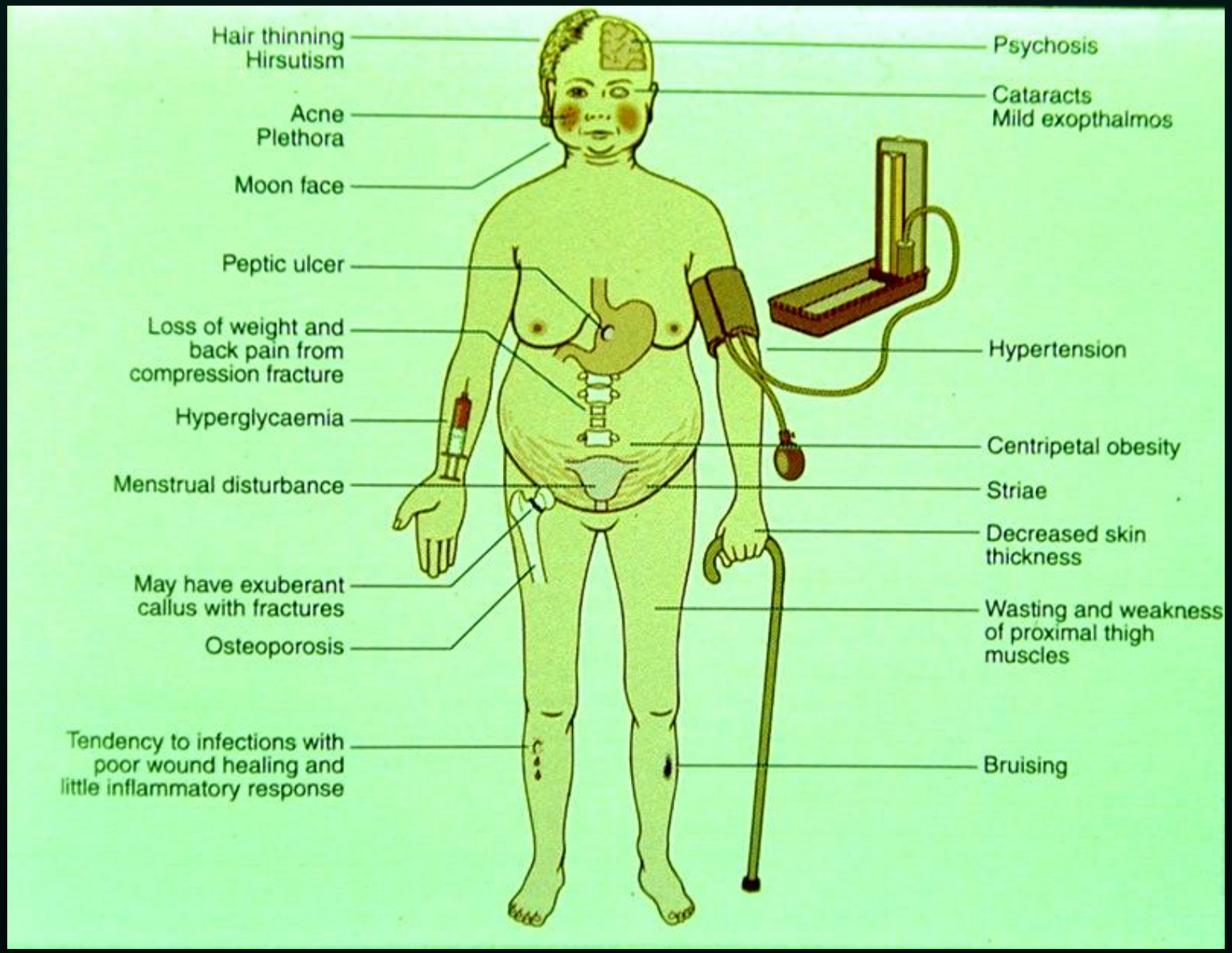
- Increases gastric acid secretion
- Increases free water clearance

Cortisol excess (Cushing syndrome)

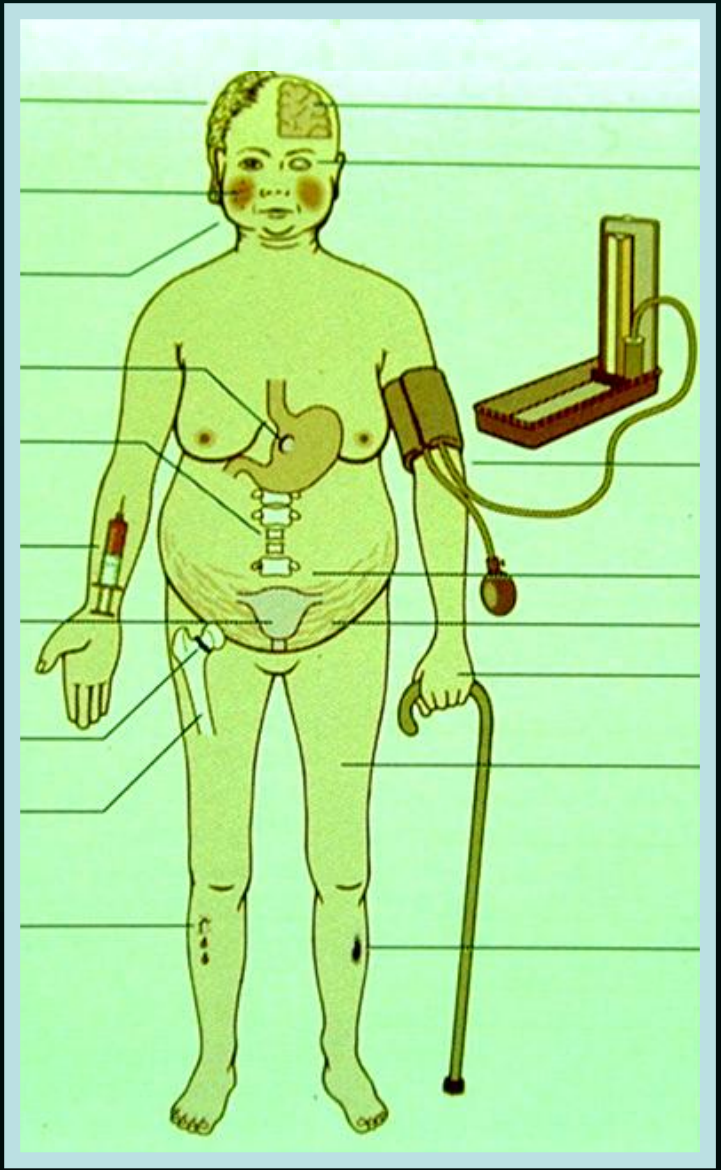
- Hyperglycemia (DM)
- Truncal (central) obesity,
- Dyslipidemia (hyper TG)
- M. wasting/weakness, thin skin, striae, impaired wound healing
- Hypertension, hypokalemia
- Hypertension

- Bone loss (osteoporosis)
- CMI defect: infections
- Lymphopenia, Eosionopenia
  Neutrophilia, Eryhtrocytosis
- Peptic ulcer
- Impaired gonadal function
- Acne (steroid acne)

Cushing's syndrome: clinical manifestations

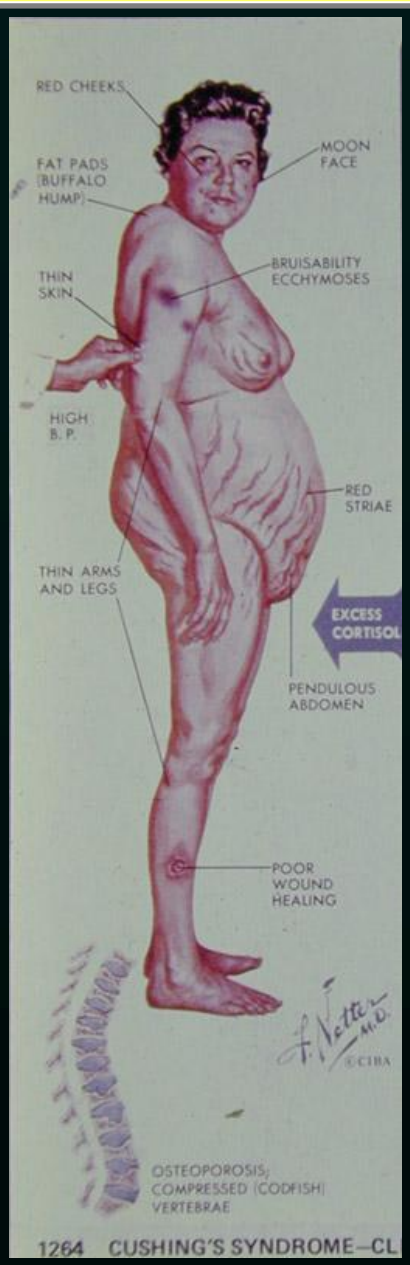


Cushing's syndrome: clinical manifestations

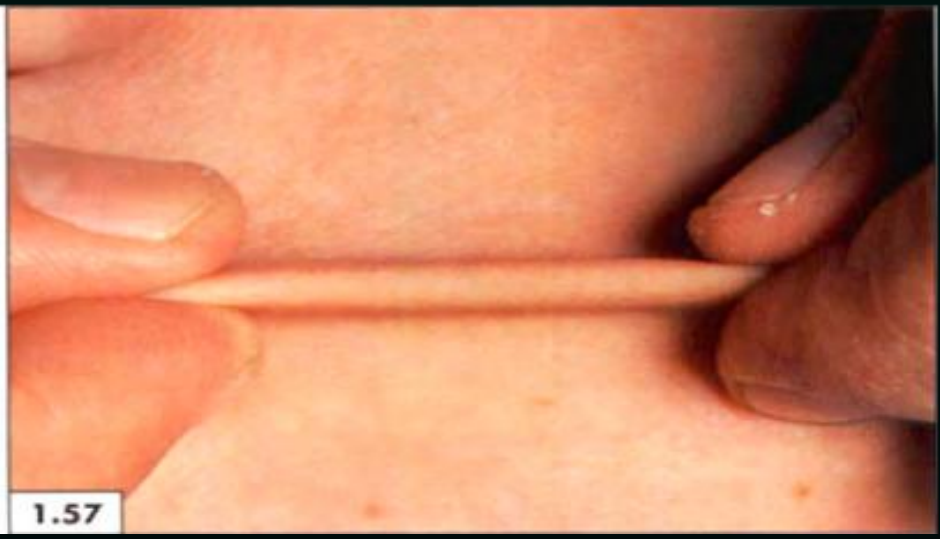


Cushing's syndrome

Cushing's syndrome

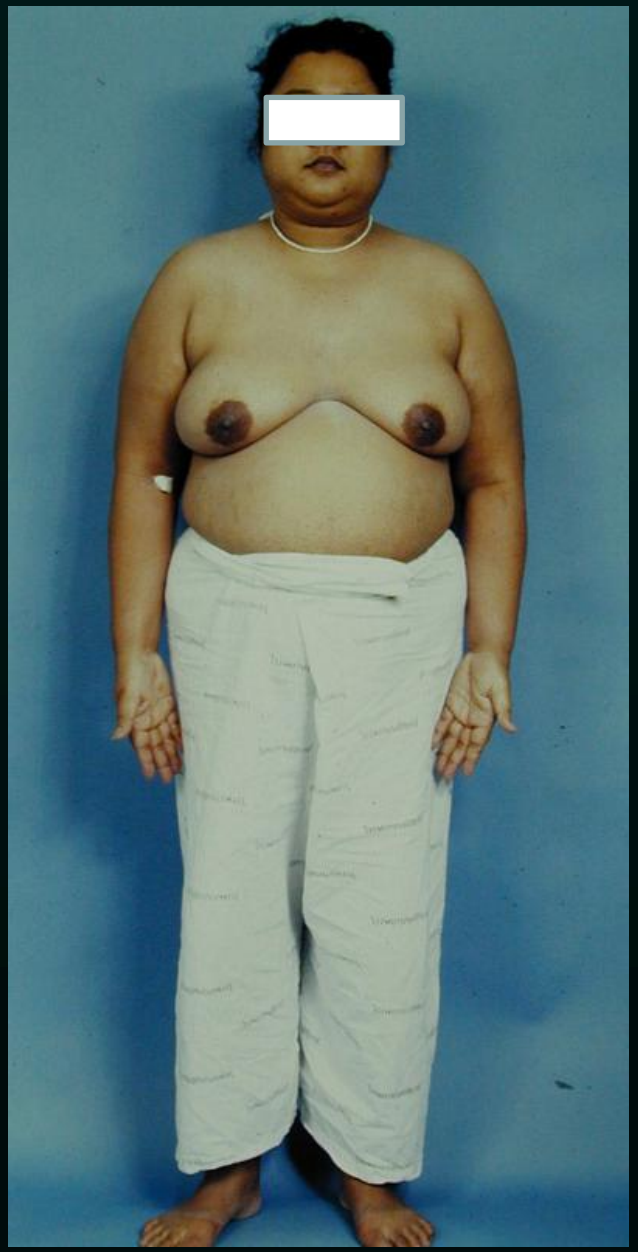


Cushing's syndrome: Thin skin



Cushing's syndrome: Easy bruising

Cushing's disease



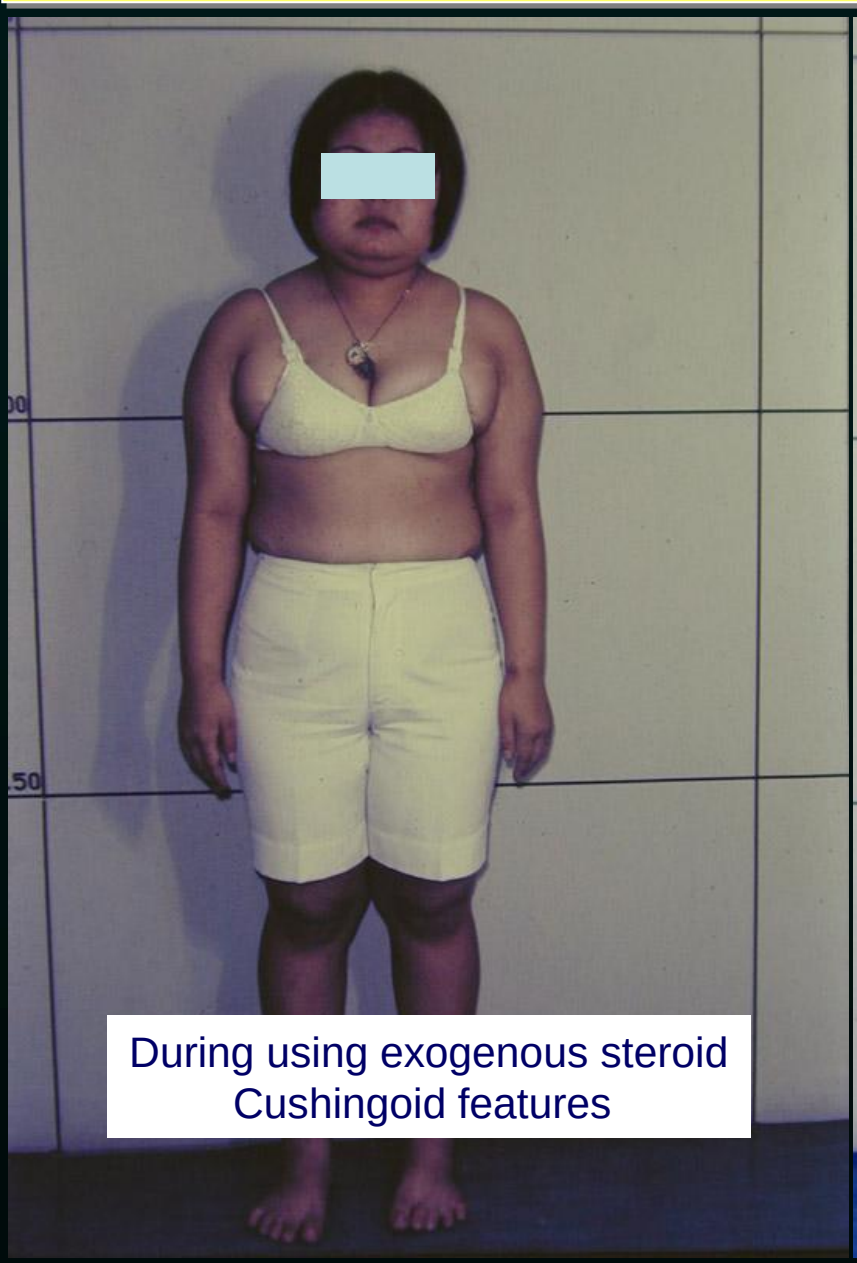
Cushing’s disease : Hyperpigmentation

Cushing's syndrome

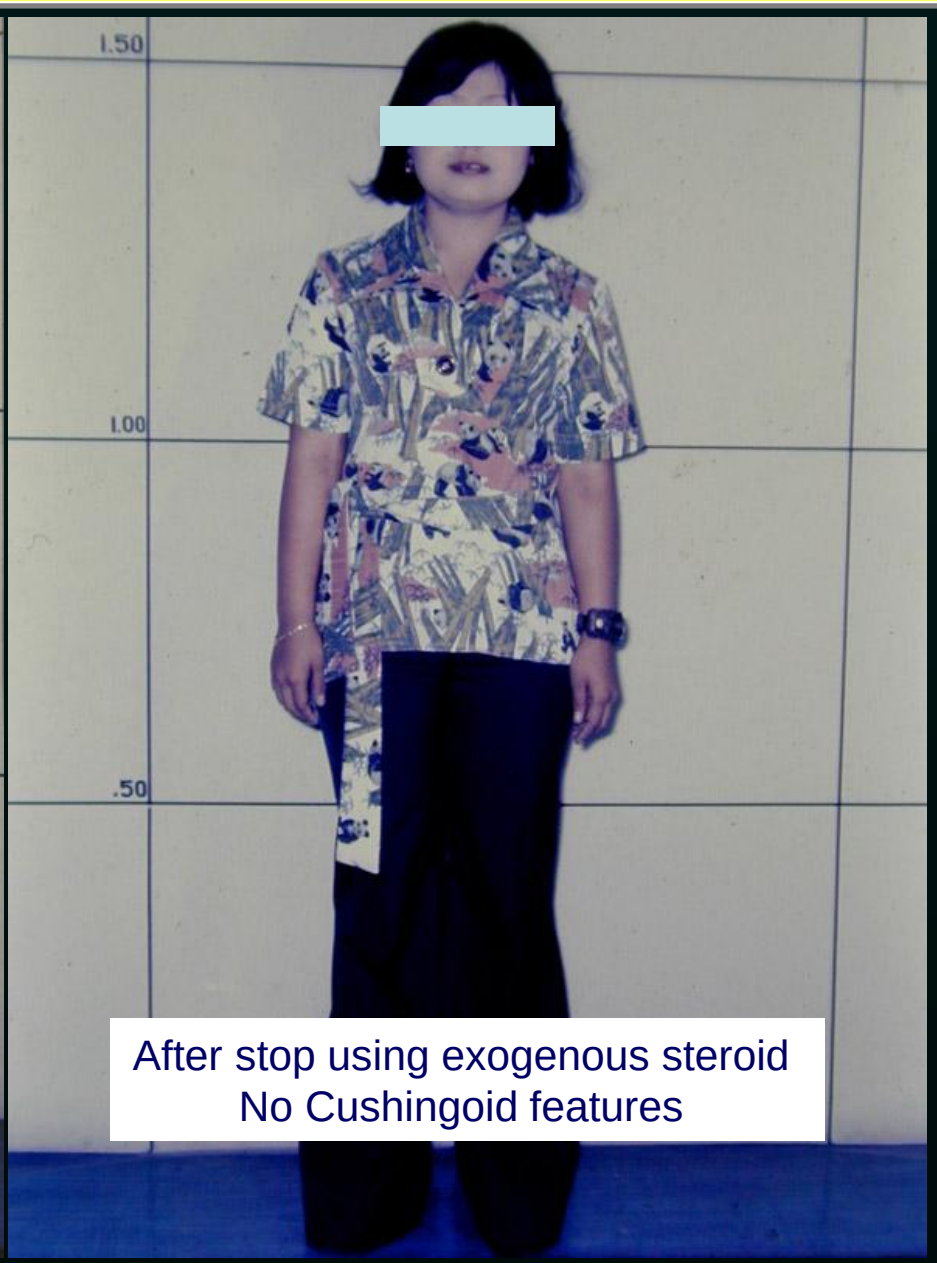
Clinical Manifestation of Cushing Syndrome

- หน้าจันทร์แรม (moon face)
- แก้มอ้อยเชื่อม (diabetes mellitus)
- เอื้อมไม่ไหว (proximal M weakness)
- ยายมีหนวด (hirsutism)
- ปวดกระดูก (fracture, AVN hip)
- ลูกทะเล (salt retention)
- เท่เหมือนควาย (buffalo hump)
- ลายหน้าท้อง (striae)
- หมอง skin (pigmentation)
- กินจนอ้วน (obesity, truncal)
- ด่วน missed mens
- เด่น pressure (hypertension)
- เจอ RC (renal stone)
- ขี่ immune (CMI defect)
- Wound healing (delay)
- Addicting steroid (exogenous Cush)
- คอยให้โต (growth retardation)
- โผล่ PU (peptic ulcer)
- ดู coag (hypercoagulable state)
- แฝงจิตเพ้อ (psychosis)
- เฮ้อ pancreatitis
- Speed adrenal (Adrenal cushing)

Exogenous Cushing's syndrome

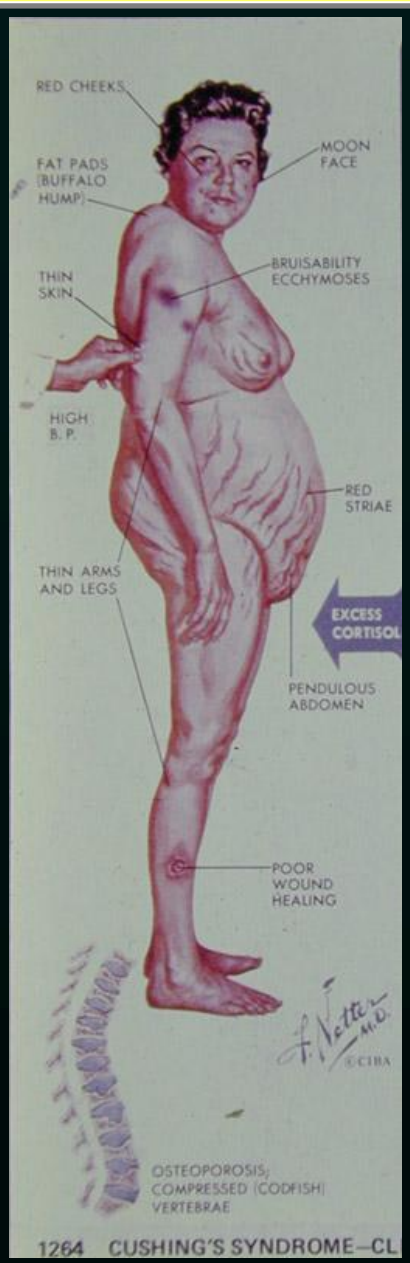


During using exogenous steroid
Cushingoid features



After stop using exogenous steroid
No Cushingoid features

Cushing's syndrome



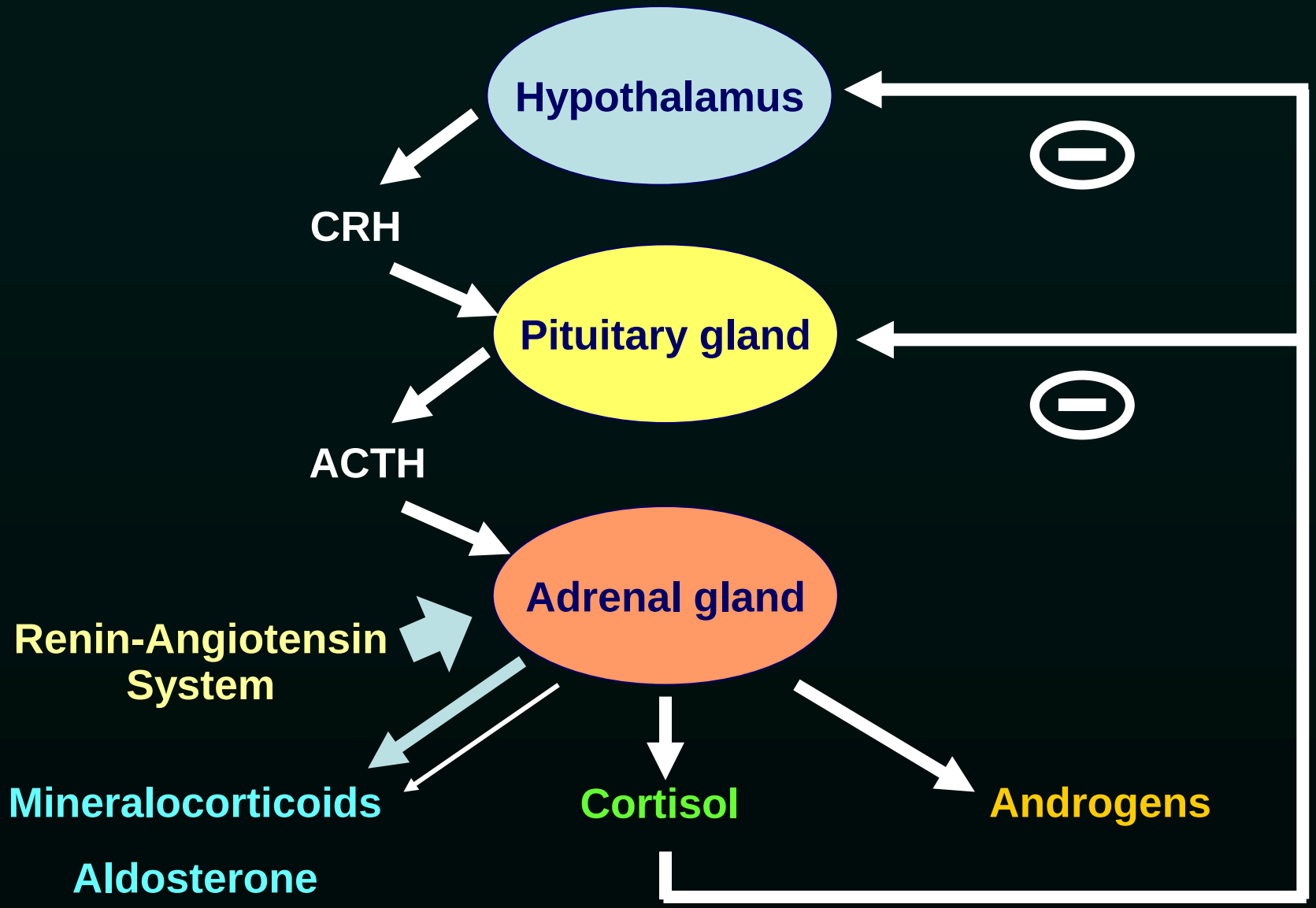
Cushing's syndrome : Response to treatment

Differential diagnosis of Cushing syndrome

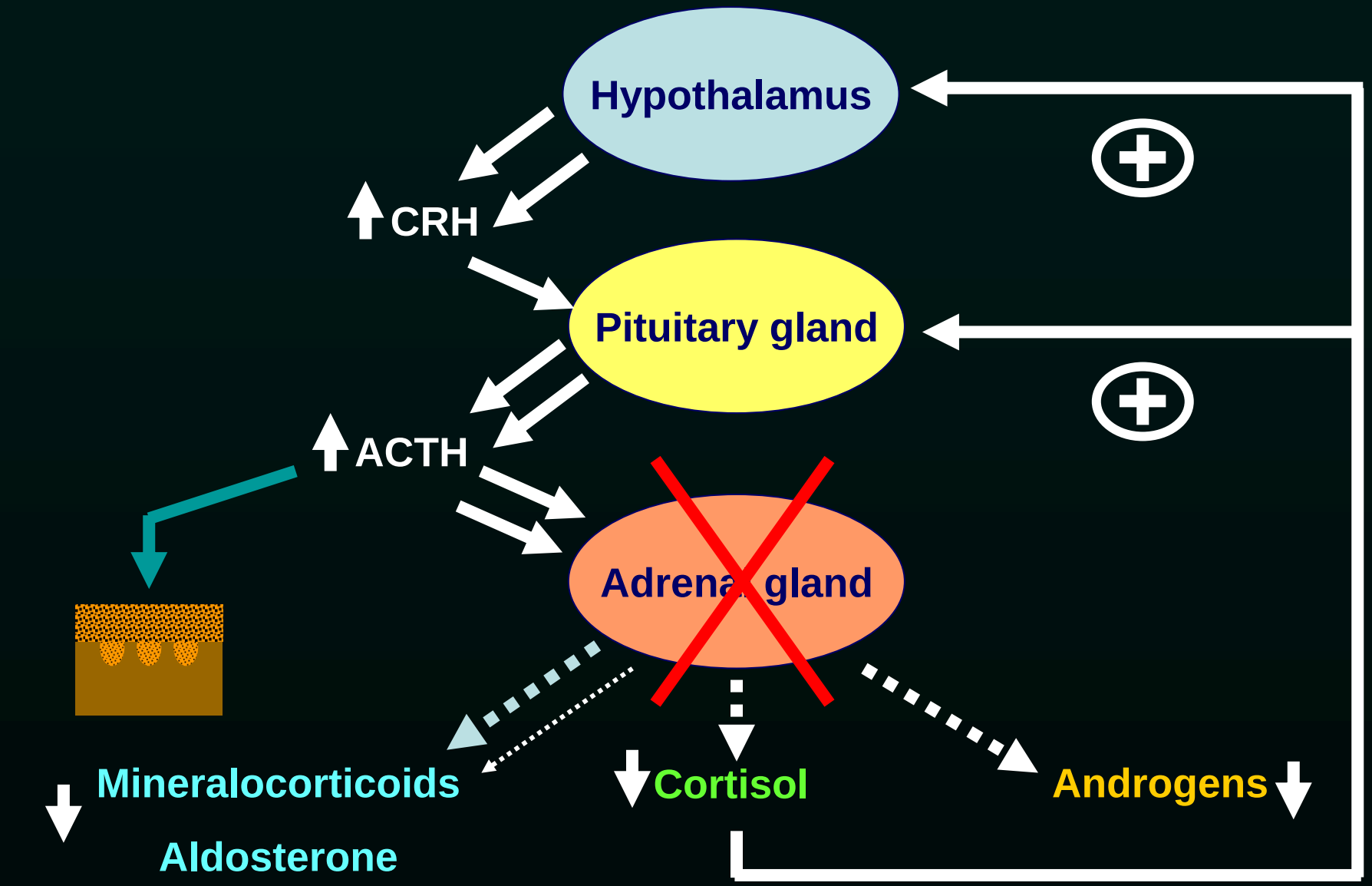
	Exogenous	ACTH dependent		Adrenal tumor	
		Cushing disease	Ectopic ACTH	Adenoma	Carcinoma
Rate of development	rapid	slow	slow - rapid	slow - rapid	rapid
Pigmentation	no	yes / no	yes / no	no	no
Androgen excess	no	no	no	no	No / yes
Basal serum cortisol	low	high	high	high	high
24-hour UFC	low	high	high	high	high
Salivary cortisol	low	high	high	high	high
Basal plasma ACTH	low	high	very high	low	low
DST		non-supp	non-supp	non-supp	non-supp

UFC = urine free cortisol, DST = dexamethasone suppression test, non-supp = non-suppressible

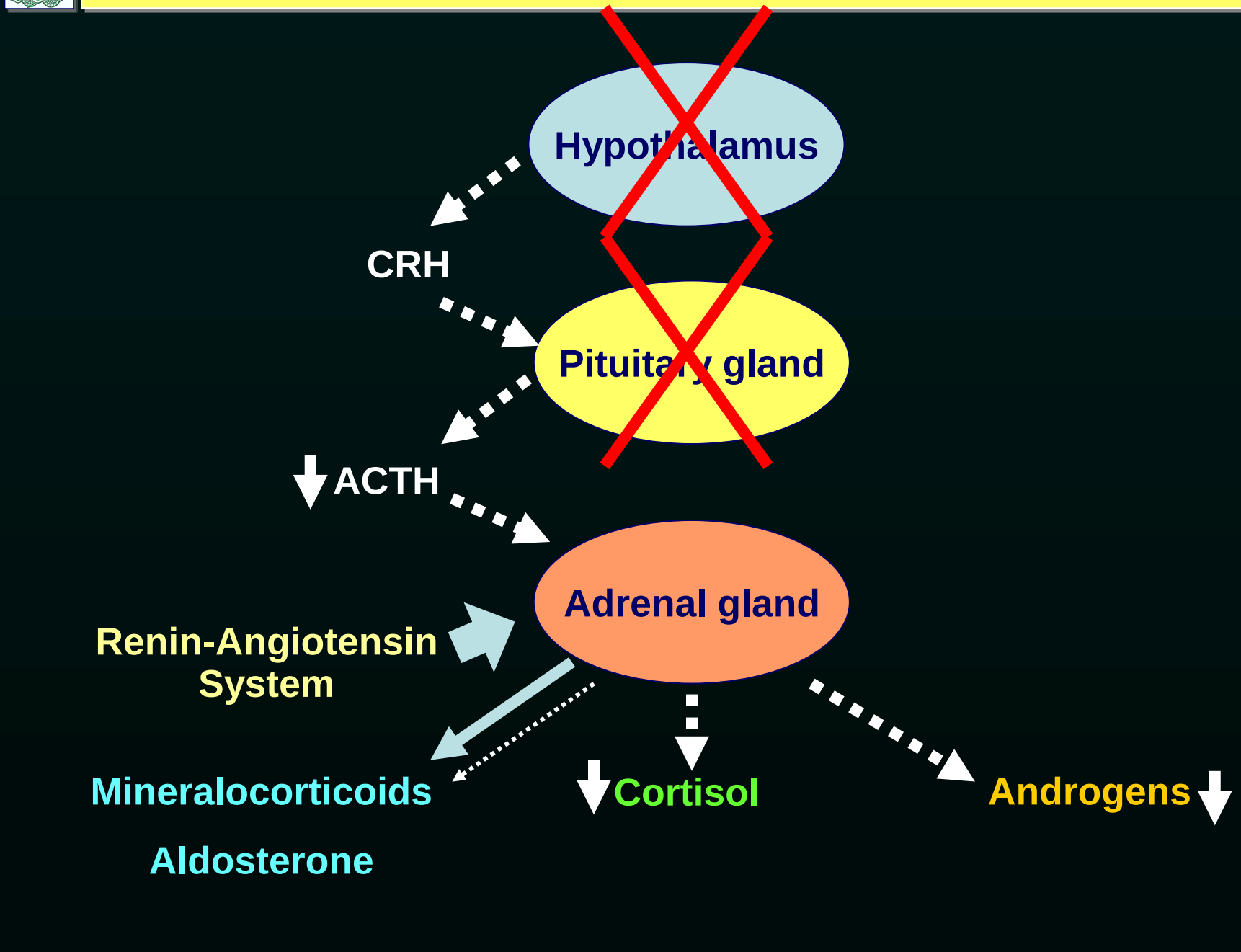
Normal hypothalamic-pituitary-adrenal axis



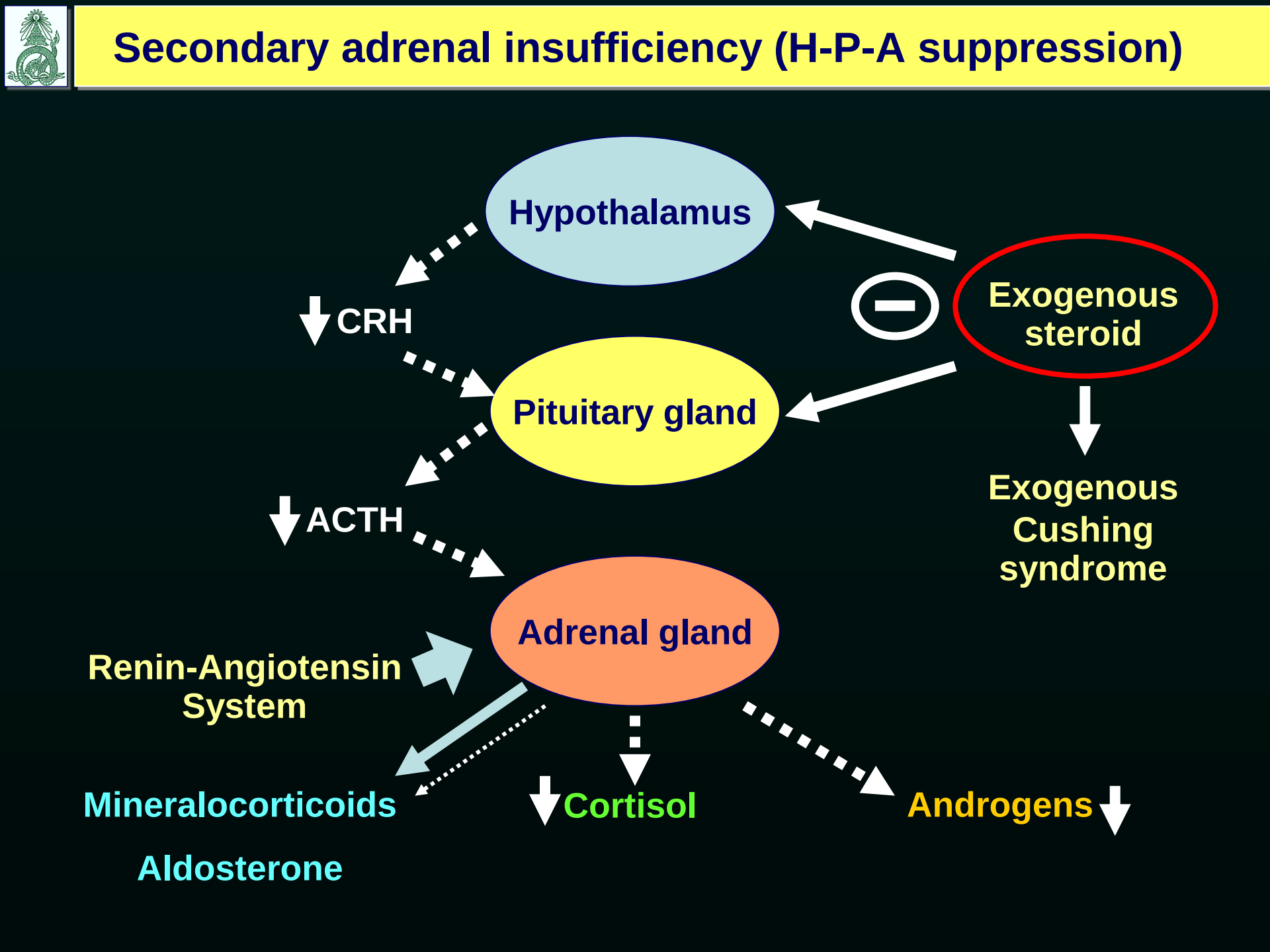
Primary adrenal insufficiency



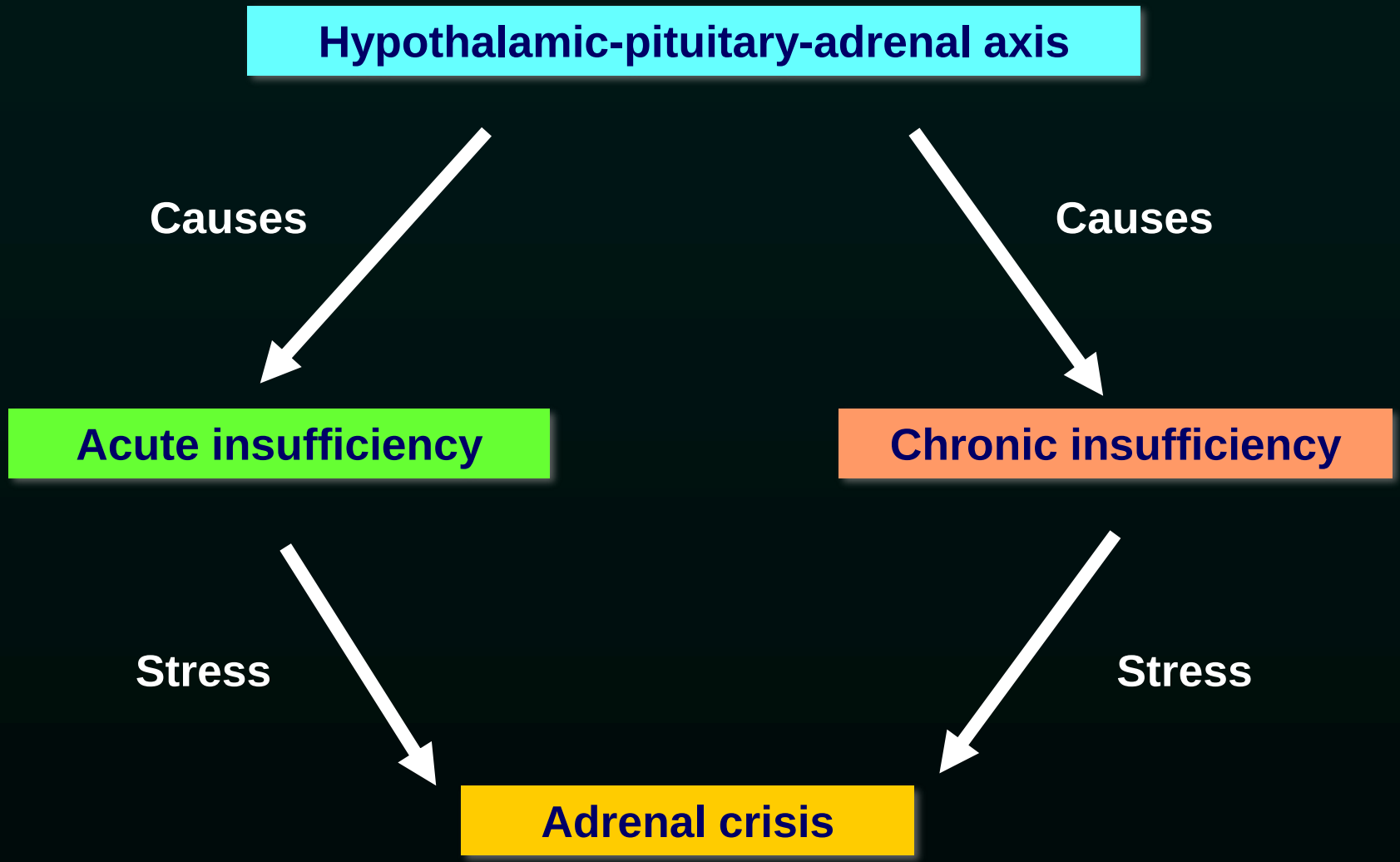
Secondary adrenal insufficiency



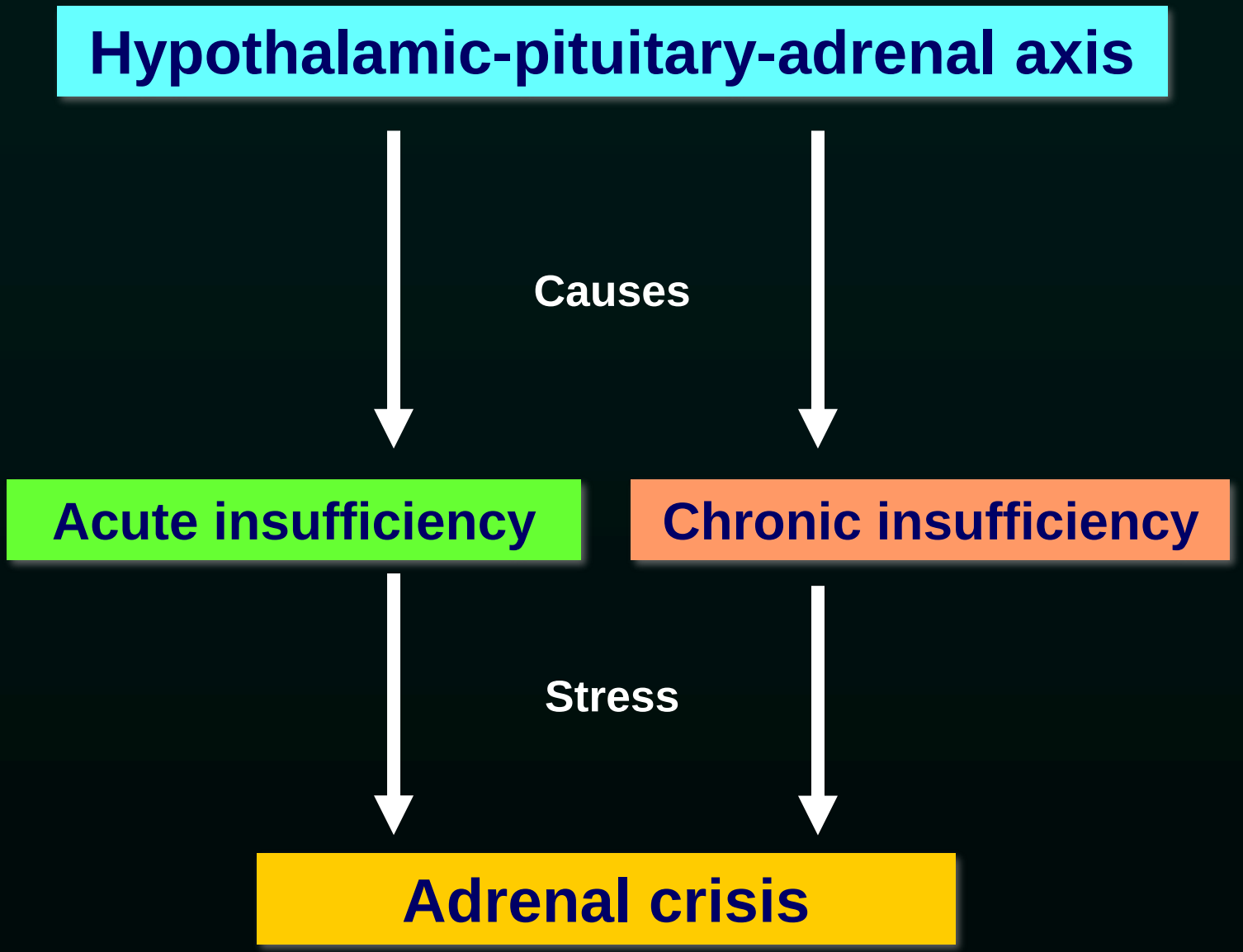
Secondary adrenal insufficiency (H-P-A suppression)



Adrenal insufficiency



Adrenal insufficiency



Causes of adrenal insufficiency

Primary

- Autoimmune
- Infections
  - Tuberculosis, Fungus, HIV
  - P. aeruginosa
  - Meningococcemia
- Metastatic tumours
- Hemorrhage
- Drugs : Ketoconazole, Etomidate

Secondary / Tertiary

- Withdrawal of corticosteroid after long-term use
- Pituitary destruction
  - Tumour
  - Surgery
  - Radiation
  - Sheehan’s syndrome
  - Hemorrhage

Biological actions of cortisol and its disorders

Biological actions	Cortisol deficiency (adrenal insuff.)
Glucose metabolism: maintain BS	Hypoglycemia
Fat and lipid metabolism	Decreased fat deposition (BW loss)
Protein metabolism	
Mineralocorticoid action	$HypoNa^+$, $hyperK^+$, hypotension
Maintain vascular tone and BP Enhance response to catecholamine	Hypotension
Bone metabolism	
Antiinflammation	
Immunosuppression	
Decr. L, Eo, Incr. PMN and RBC	Eosinophilia, lymphocytosis
Increases gastric acid secretion	
Increases free water clearance	Hyponatremia
Main mood and appetite	Anorexia, nausea

Clinical features of adrenal insufficiency

Chronic

- Weakness, fatigue
- Anorexia, weight loss
- GI disturbances
- Hypotension
- Postural symptom (primary)
- Hyperpigmentation (primary)
- Pituitary insufficiency (secondary)

Acute / Crisis

- Weight loss
- Apathy, mental change
- GI disturbances
- Hypotension / Shock
- Hypoglycemia
- Dehydration
- Volume depletion (primary)

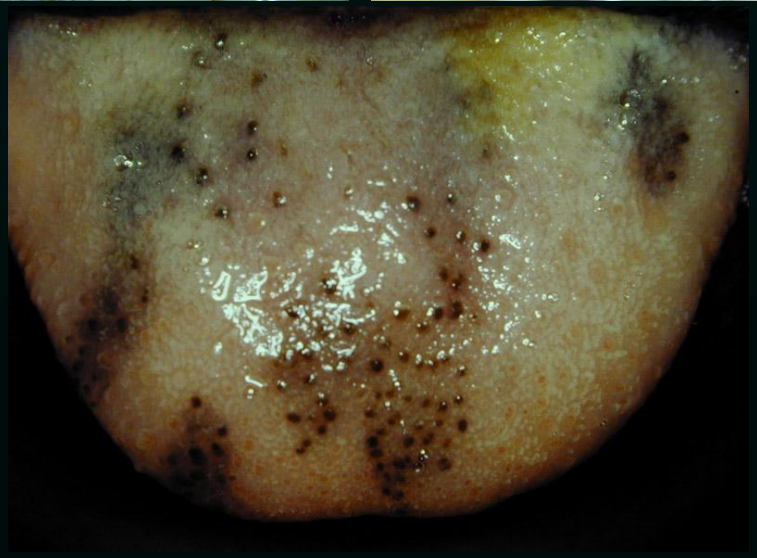
Primary vs. Secondary adrenal insufficiency

	Primary	*Secondary*
Etiology	Autoimmune, TB, Fungus, HIV, Metastatic tumour, Haemorrhage, Drug	Corticosteroid treatment, Sheehan's syndrome, Pituitary tumour
Hyperpigmentation	Yes / No	No
Electrolyte disturbance	Na^+ ↓, K^+ ↑, $HCO3^-$ ↓	Na^+ ↓
Plasma ACTH levels	High	Low or normal
Response to ACTH	No	Yes

Chronic primary adrenal cortical insufficiency : Addison's disease

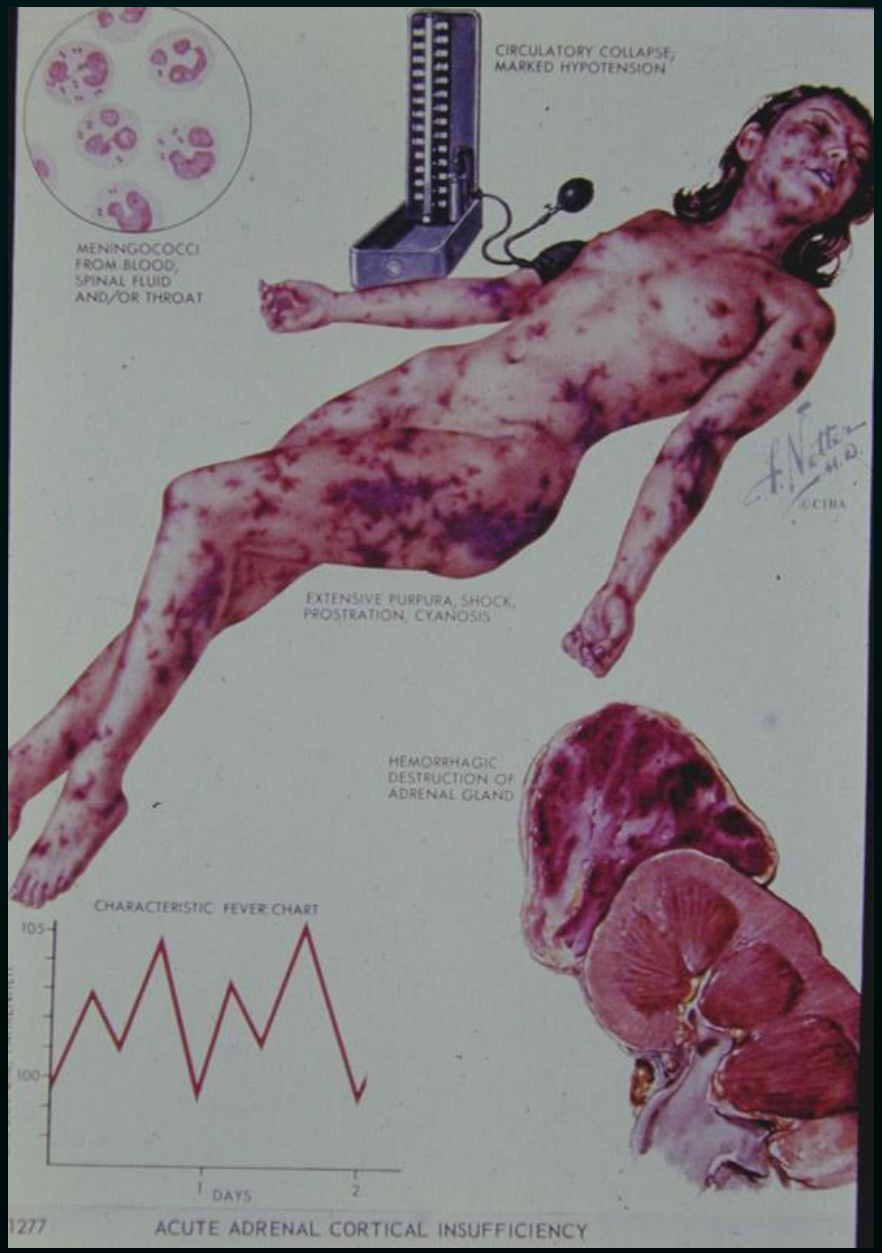
- Weakness, fatigue
- Anorexia, weight loss
- GI disturbances
- Hyponatremia, hyperkalemia
- Hypotension
- Postural symptom
- Hyperpigmentation

Addison’s disease : Hyperpigmentation



Addison’s disease : Hyperpigmentation

Acute adrenal cortical insufficiency (crisis)



- Weight loss,
- Apathy, mental change
- GI disturbances
  - Nausea, vomiting
- Dehydration
- Volume depletion
- Hypotension / Shock
- Hypoglycemia

Acute adrenal insufficiency : Meningococcemia

Diagnosis of adrenal crisis

- Unexplained hypotension / shock
- Hyponatremia with hyperkalemia
- Unexplained hypoglycemia
- Known underlying pituitary disorders
- Known underlying diseases or conditions which can destroy adrenal or pituitary glands
- History of corticosteroid administration

Physiology of renin-angiotensin aldosterone system

Major factors

Renin-angiotensin system → Angiotensin II

Potassium ↑

ACTH

Aldosterone

Modulating factors

Low salt diet ↑

High salt diet ↓

} Effect of Angiotensin II

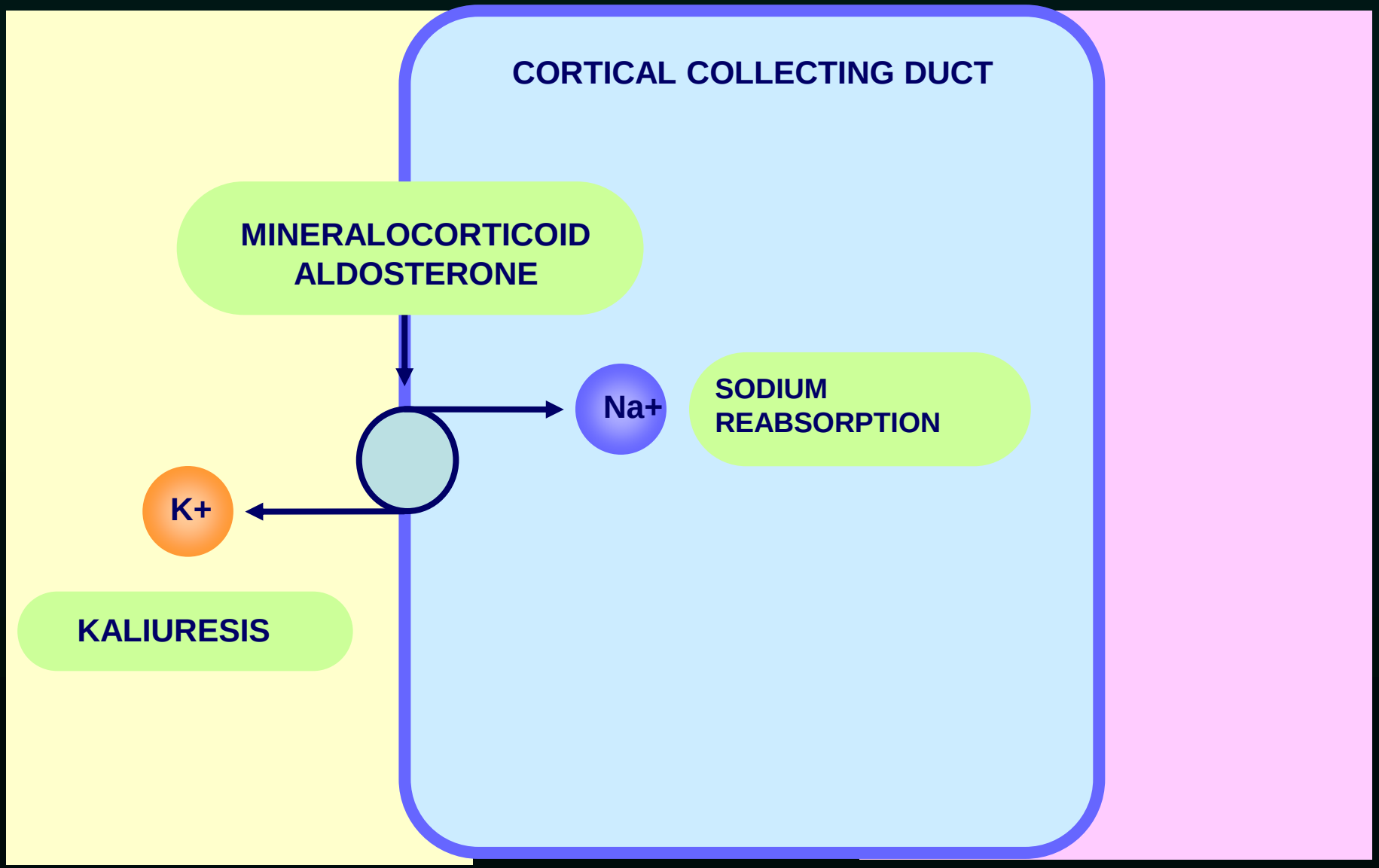
Minor factors

Serotonin ↑

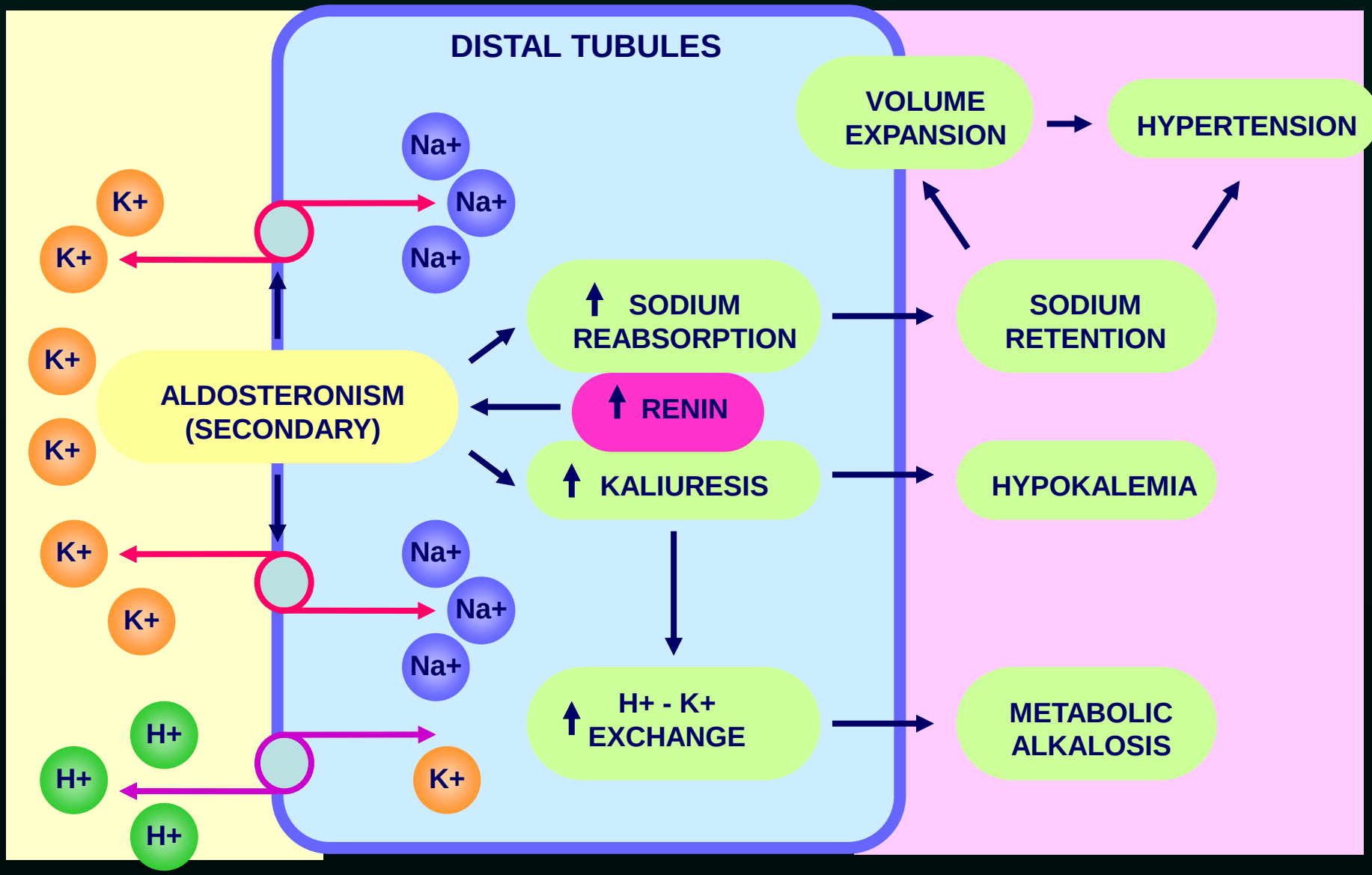
Dopamine antagonists ↑

Dopamine ↓

Mineralocorticoid (aldosterone) action



Secondary (hyper)aldosteronism



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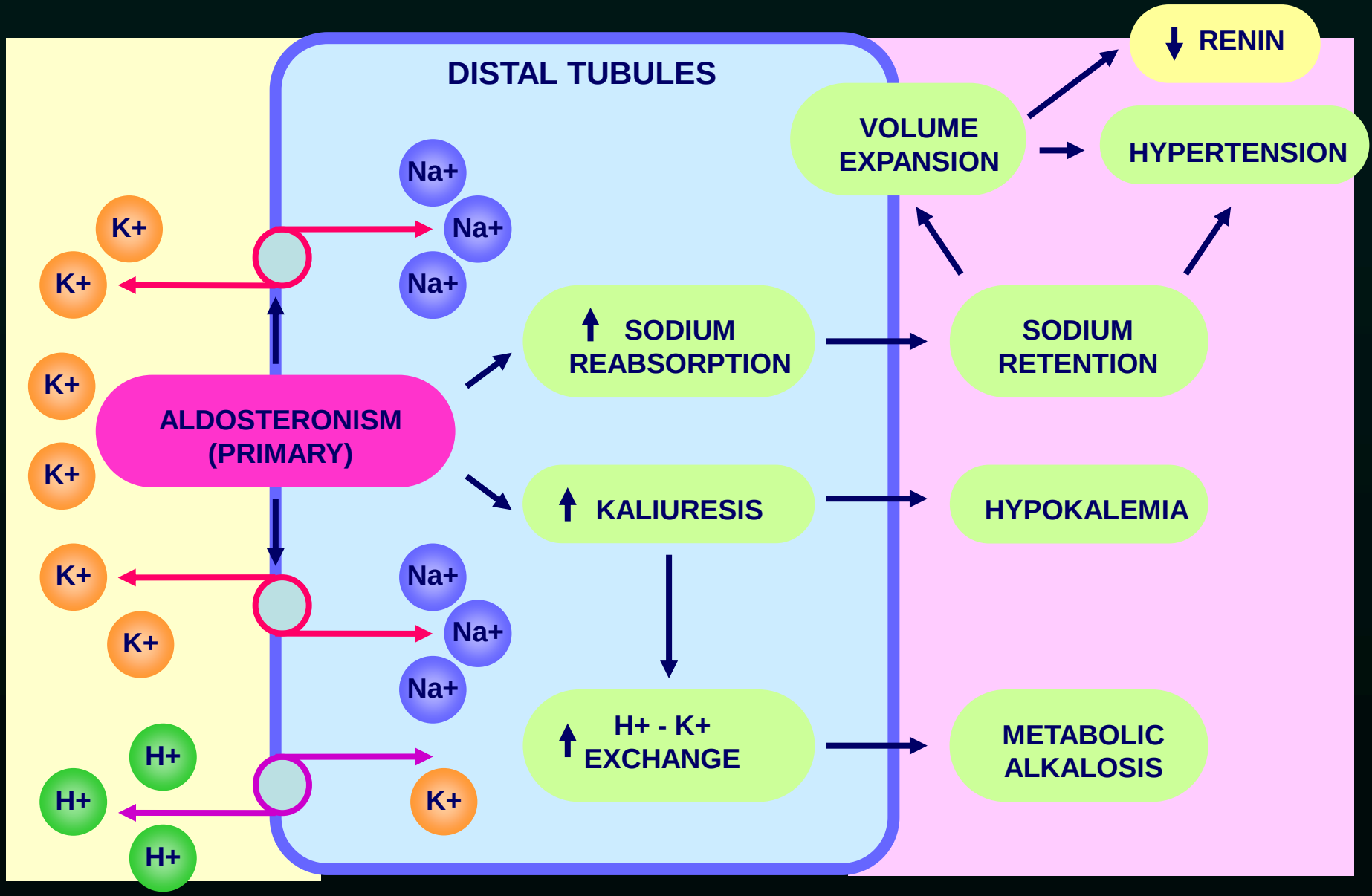
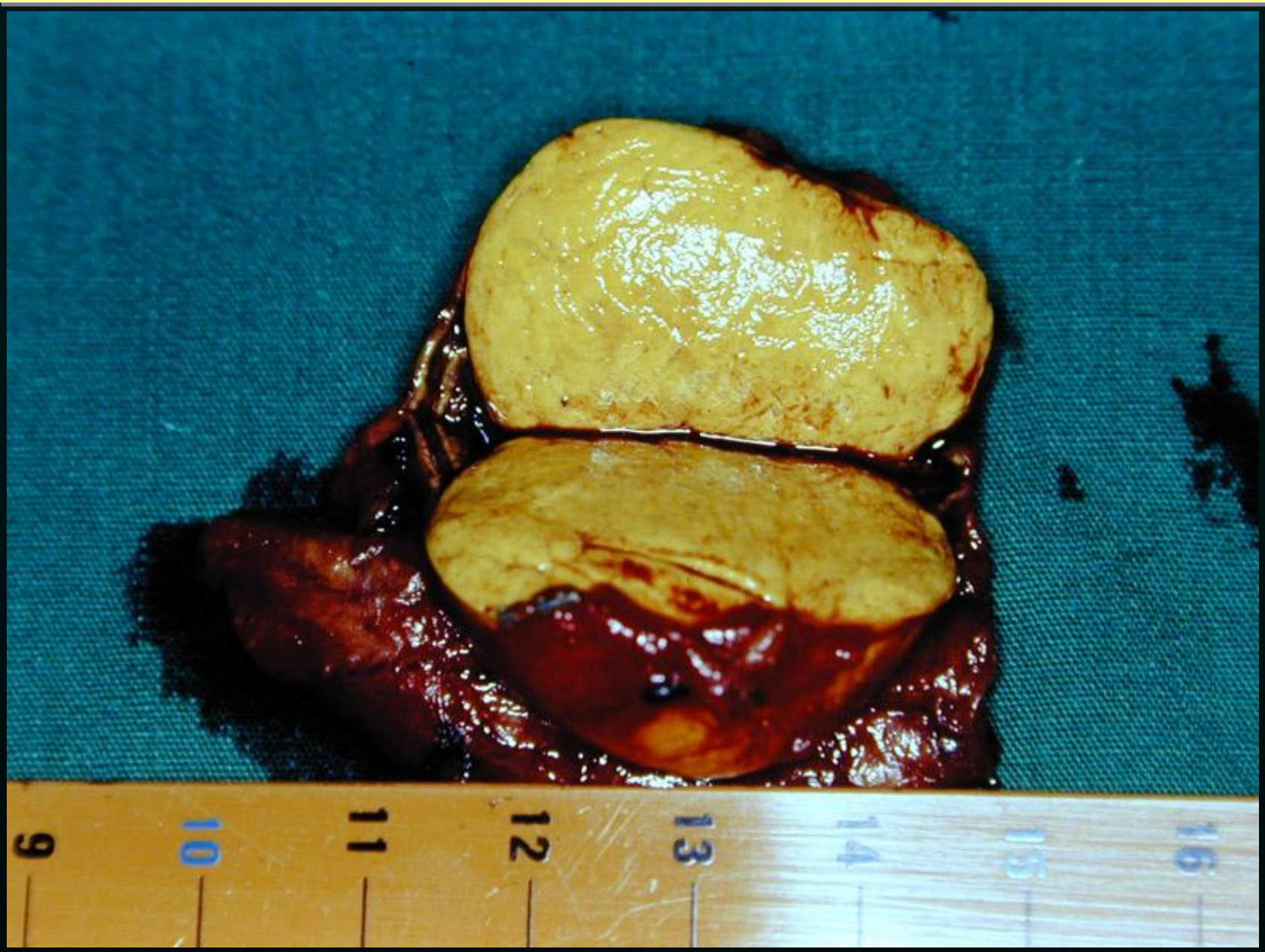
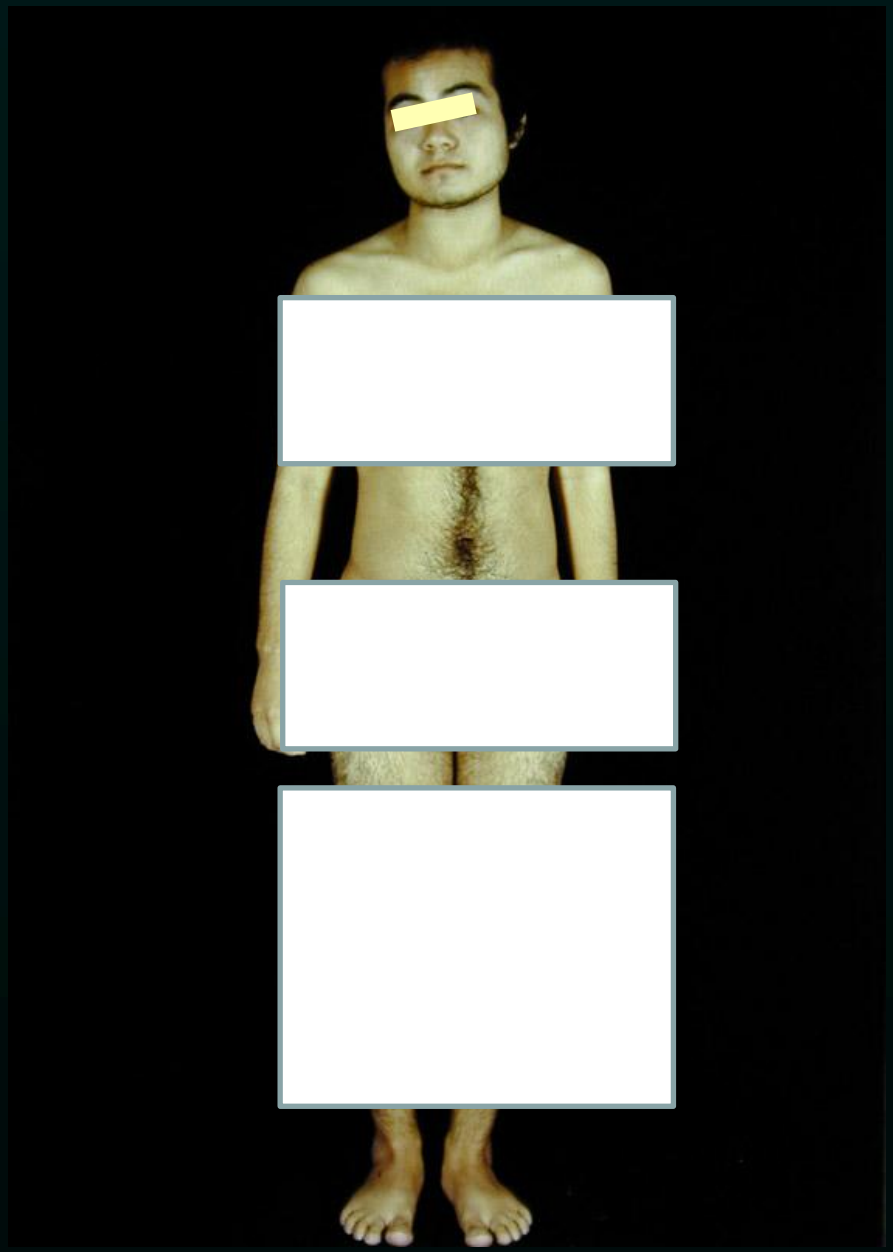


Aldosterone producing adreno-cortical adenoma



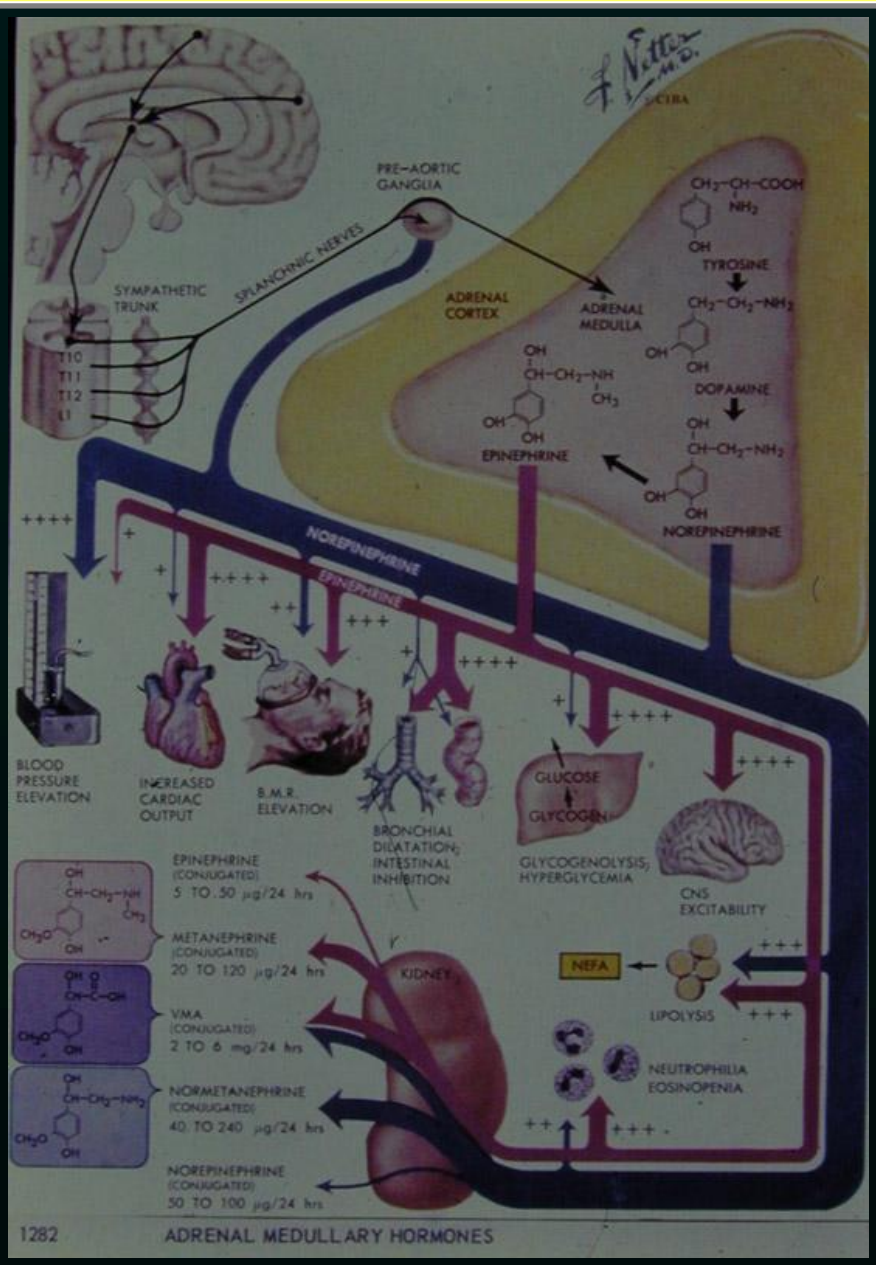
Describe the abnormalities



Androgen excess in female

- Hirsutism (excess of terminal hair in female)
- Acne (androgenic)
- Oligomenorrhea / amenorrhea
- Virilization
  - Changes of body habitat
  - Deepening of voice
  - Clitoromegaly
  - Temporal baldness

Adrenal medullary hormones



Memory aids to important features of phaeochromocytomas

Six Hs

- Hypertension
- Headache
- Hyperhydrosis
- Hyperglycemia
- Hypermetabolism
- Hypomotility of gut

Four Cs

- Cutaneous lesions
- Cerebellar hemangioblastoma
- Cushing's syndrome
- Cholelithiasis

Rule of 10

- 10% bilateral
- 10% extra-adrenal paragangliomas
- 10% has family history (genetics, up-to 30%)
- 10% occur in children
- 10% hyperglycemia
- 10% hypermetabolism

THANK YOU