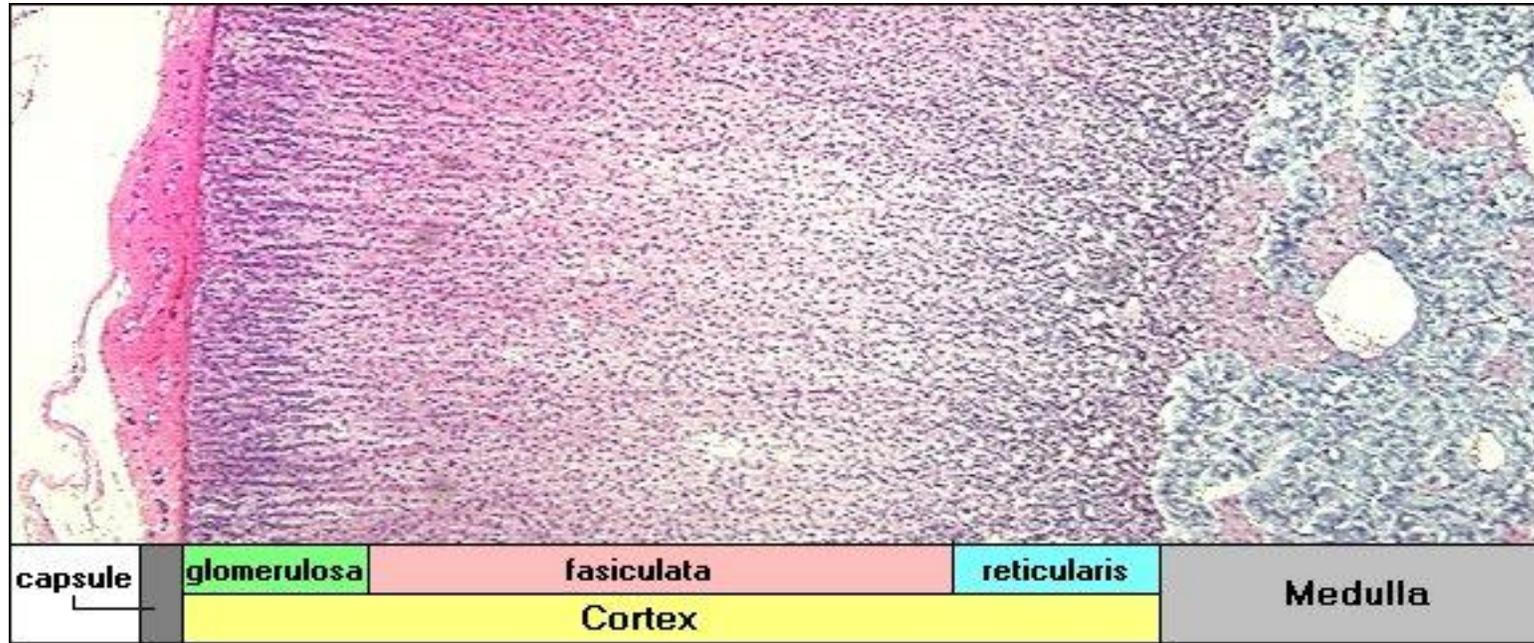




# The Adrenal Glands

**A paired endocrine organs; the cortex &  
medulla**

zona  
fasciculata  
largest zone



zona  
glomerulosa  
the least  
thickness  
affect  
nephrons  
and sodium  
water  
retention

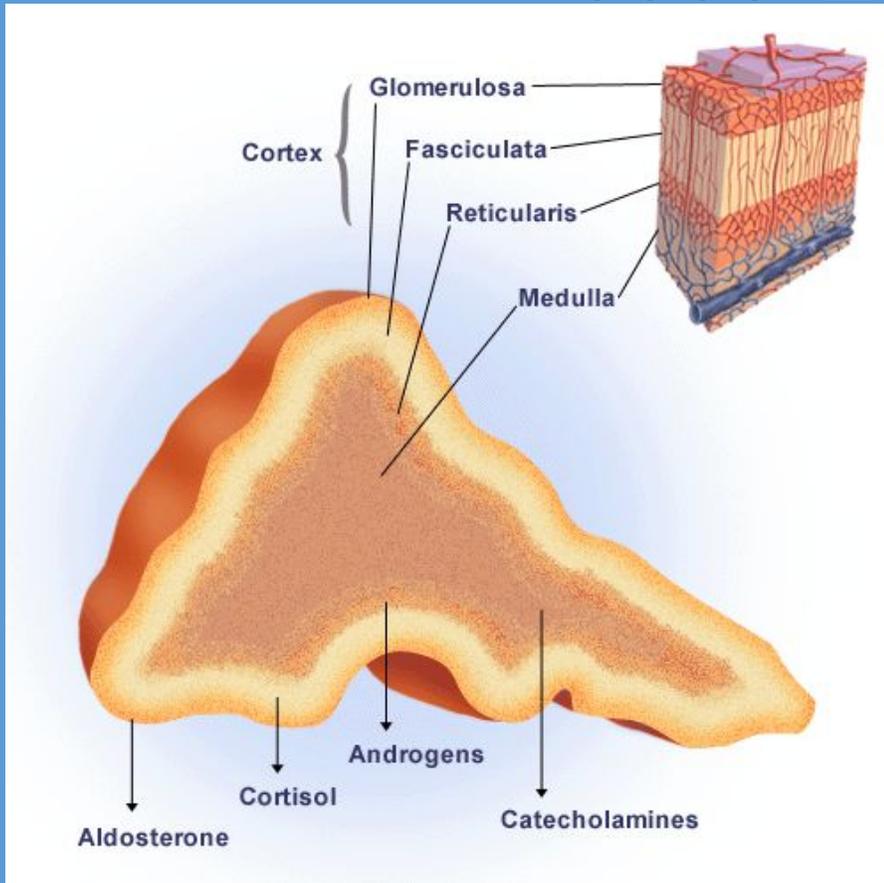
# Adrenal Cortex

Synthesizes three different types of steroids:

- Glucocorticoids (cortisol), zona fasciculata, zona reticularis (small contribution)
- Mineralocorticoids (aldosterone) zona glomerulosa
- Sex steroids (estrogens and androgens), zona reticularis

sex hormones important in  
sexual secondary characteristics  
and sexual growth in female  
and male

# ADRENOCORTICAL HYPERFUNCTION



three distinctive hyperadrenal clinical syndromes:

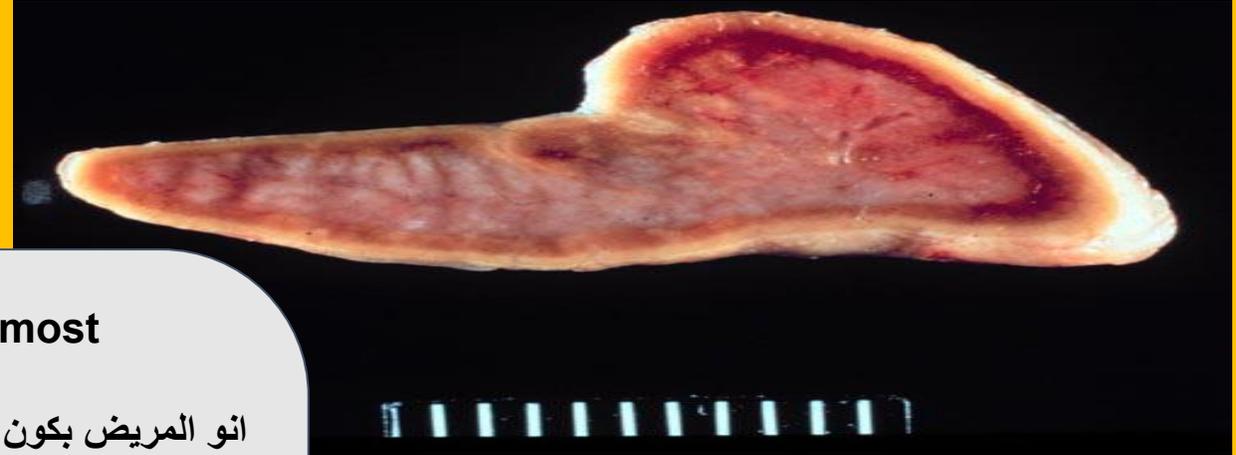
- *Cushing syndrome*: an excess of cortisol.
- *Hyperaldosteronism*: an excess of mineralocorticoid.
- *Adrenogenital or virilizing syndromes*: an excess of androgens.

# Morphology

- Morphologic changes in the adrenal glands also depend on the cause of the hypercortisolism and include:
  - (1) Cortical atrophy,
  - (2) Diffuse hyperplasia,
  - (3) Macronodular or micronodular hyperplasia,
  - (4) An adenoma or carcinoma.

# Morphology - Cortical atrophy

- Syndrome results from exogenous glucocorticoids □ suppression of endogenous ACTH □ bilateral **cortical atrophy**, due to a lack of stimulation of zona fasciculata and zona reticularis by ACTH



ACTH is inhibited due negative feed back by cortisol ,so the most important cause to cushing syndrome

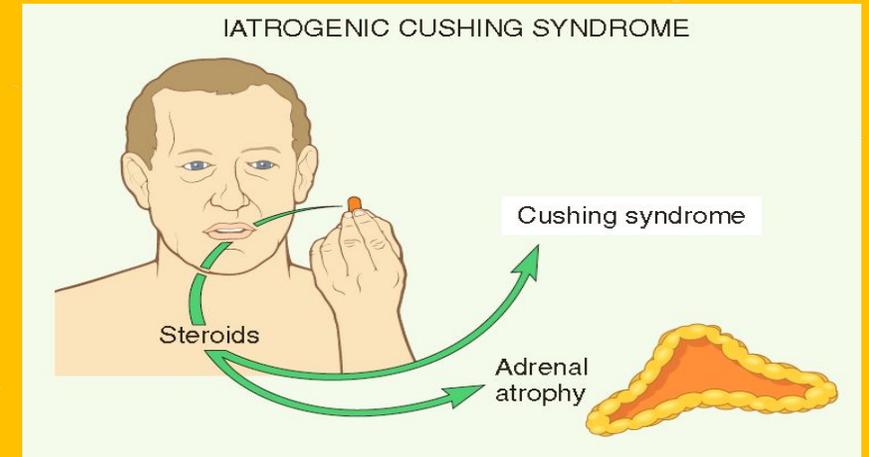
انوَ المریض بكون عم یاخذ  
exogenous  
cortisol

لعالج ال  
autoimmune diseases  
RA ,SLE, lung diseases

بالتالي حاليا استخدامہ قل ك  
immunesupressive

another causes of atrophy is tumor in adrenal gland adjacent to the tumor that secret cortisol will be atrophed because tumor secrete cortisol indepent to ACTH

and atrophy occur adjacent to hyperplasia , if we have hyperplasia in right side the left side will atrophed

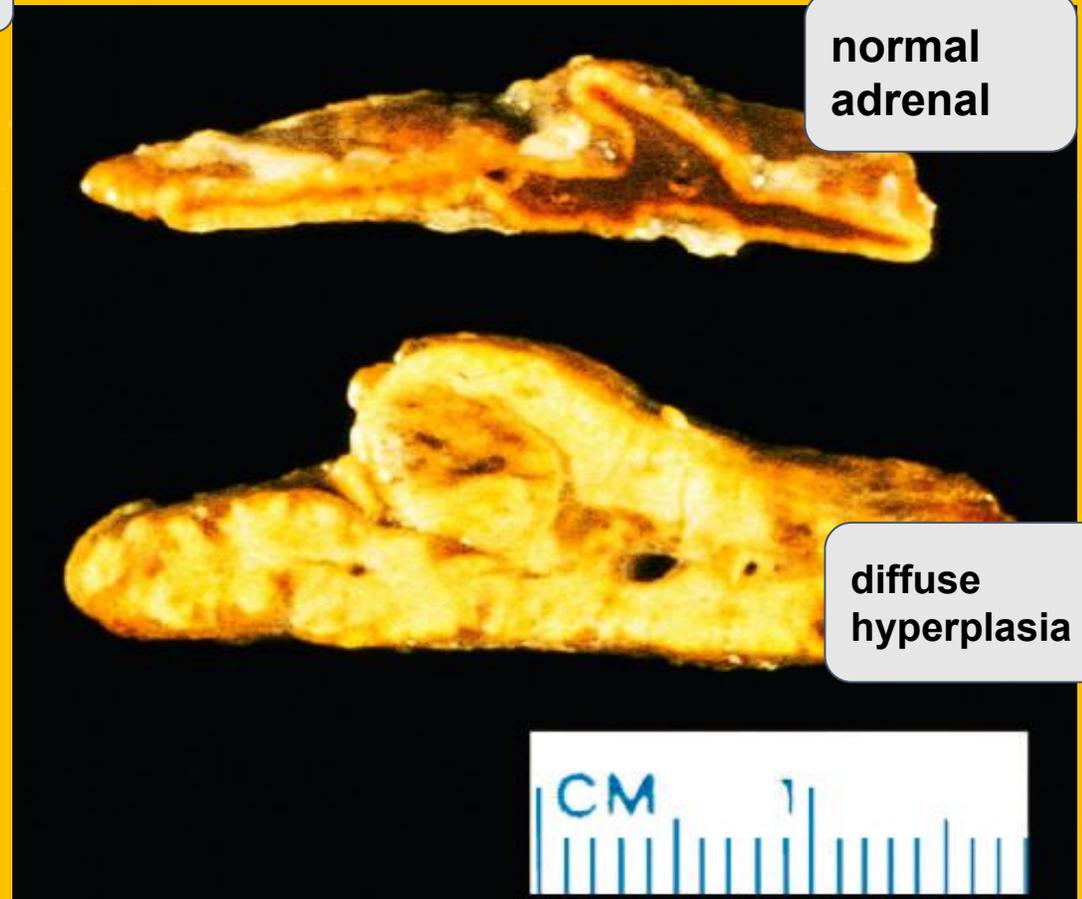


# Morphology - Diffuse hyperplasia

- ACTH-dependent Cushing syndrome.
- Both glands are enlarged, each weighing up to 30 g.
- Cortex is diffusely thickened w subtle nodularity.
- Yellowish in color □ presence of **lipid-rich cells** □ appear vacuolated under the microscope.

cushing disease

normal adrenal



diffuse hyperplasia

hyperplasia due to ACTH secreting adenoma in pituitary  
rarely due to tumor in lung paraneoplastic syndrome  
and tumor in hypethalamous that increase secretion of CRH

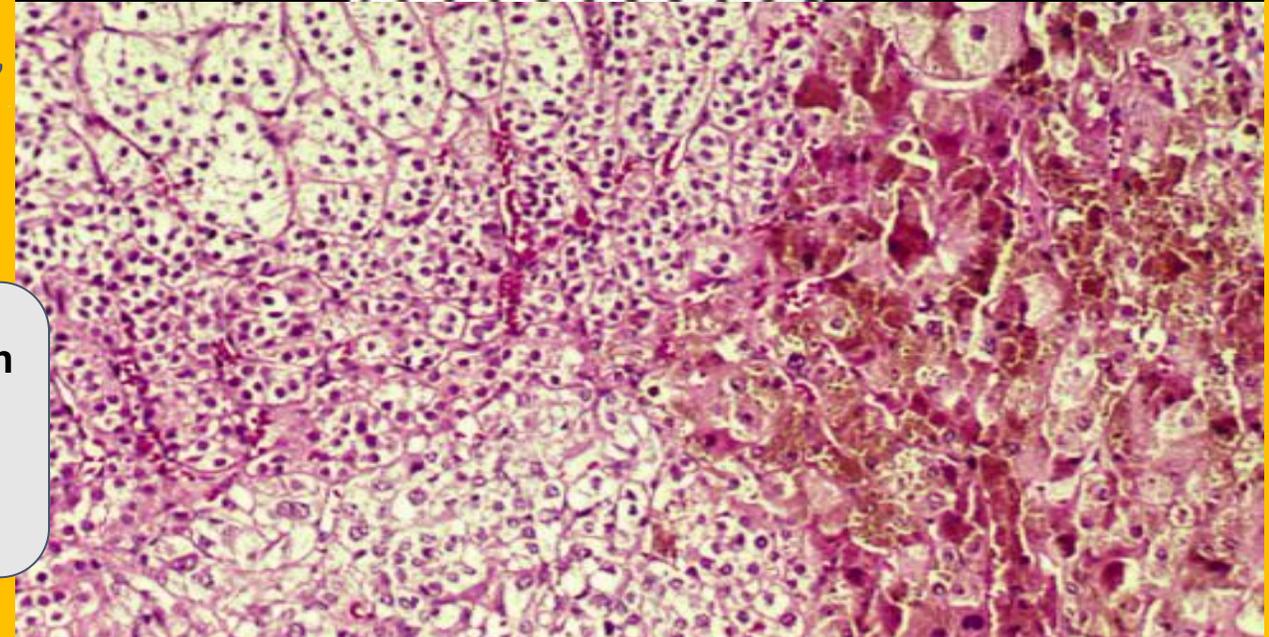
paraneoplastic syndrome cause hyperplasia more than atrophy

# Morphology - Nodular hyperplasia

- In **primary cortical hyperplasia**, the cortex is replaced almost entirely by **macronodules** or 1- to 3-mm darkly pigmented **micronodules**
- The pigment is believed to be lipofuscin, a wear-and-tear pigment

wear and tear pigment  
caused by continuous  
growth of cell  
cellular accumulation >>  
free radical

little brown stain  
>>> wear and tear  
pigment not  
melanin



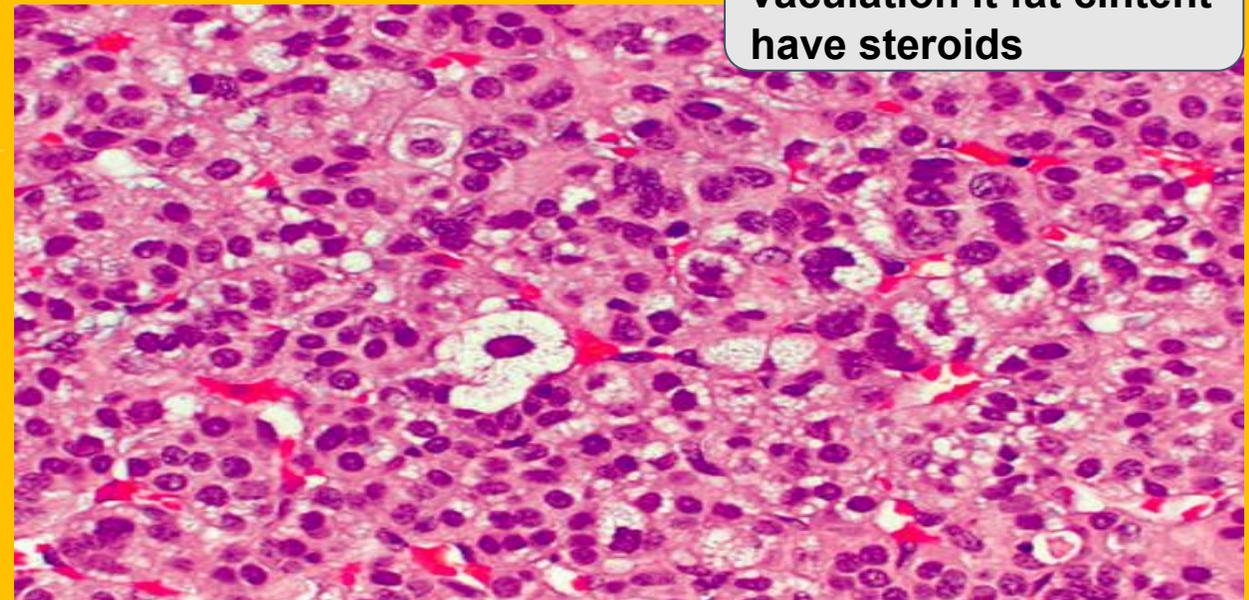
# Morphology - Adenoma or carcinoma

- Both are more common in women in their 30s -50s.
- Only definitive criteria for malignancy are distant metastasis or local invasion.
- Functioning tumors, both benign & malignant, causes adjacent adrenal cortex & contralateral adrenal gland are atrophic.

because the tumor secrete cortisol so cause negative feed back inhibition of ACTH  
>>>>ATROPHY of adjacent area  
also if we have hyperplasia in left adrenal the right adrenal will have decrease in ACTH so right adrenal will atrophied

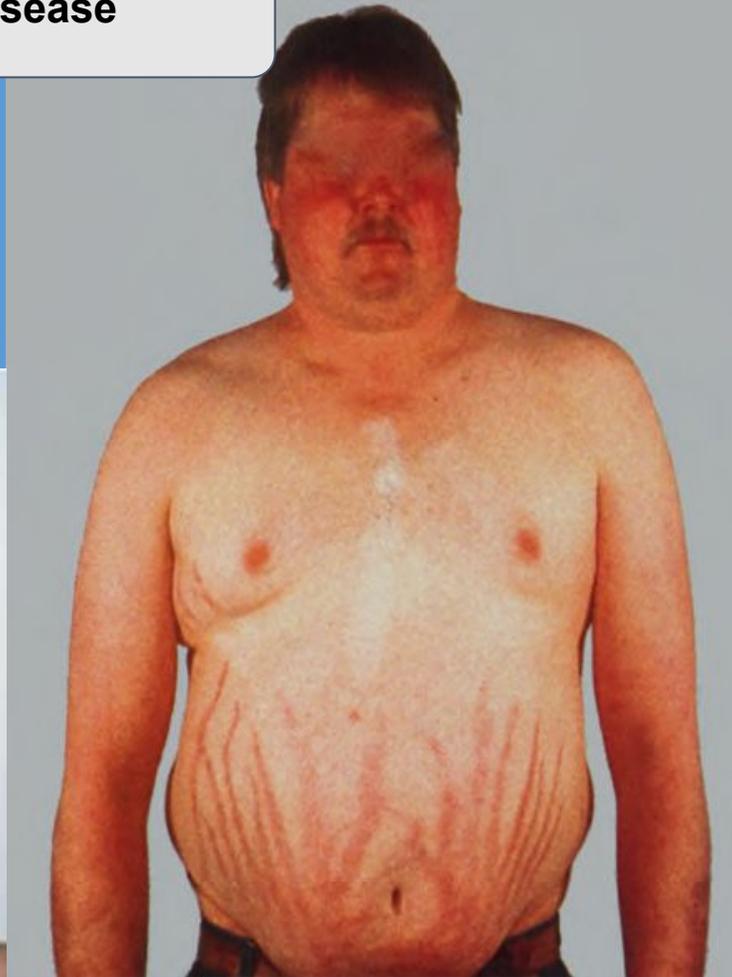


irrgular polifration  
vaculation it fat cintent  
have steroids



# Clinical Features- weight gain

cushing disease



**characteristic**  
**centripetal**  
**redistribution of**  
**adipose tissue**  
**becomes apparent**  
**with time** □ **truncal**  
**obesity, “moon**  
**facies” &**  
**accumulation of fat**  
**in the posterior**  
**neck & back**  
**“buffalo hump”.**

insulin resistance catabolic  
effect due to break down of  
collagen >>> thin skin

# Clinical Features:

+ Catabolic effects of insulin resistance on proteins □ loss of collagen □ skin is thin, fragile, & easily bruised cutaneous **striae** (common in abdominal area)

+ Cortisol □ resorption of bone □ development of **Osteoporosis** □ ↑↑ susceptibility to fractures.  
+ Glucocorticoids **suppress** immune response □ ↑↑ risk for a variety of infections

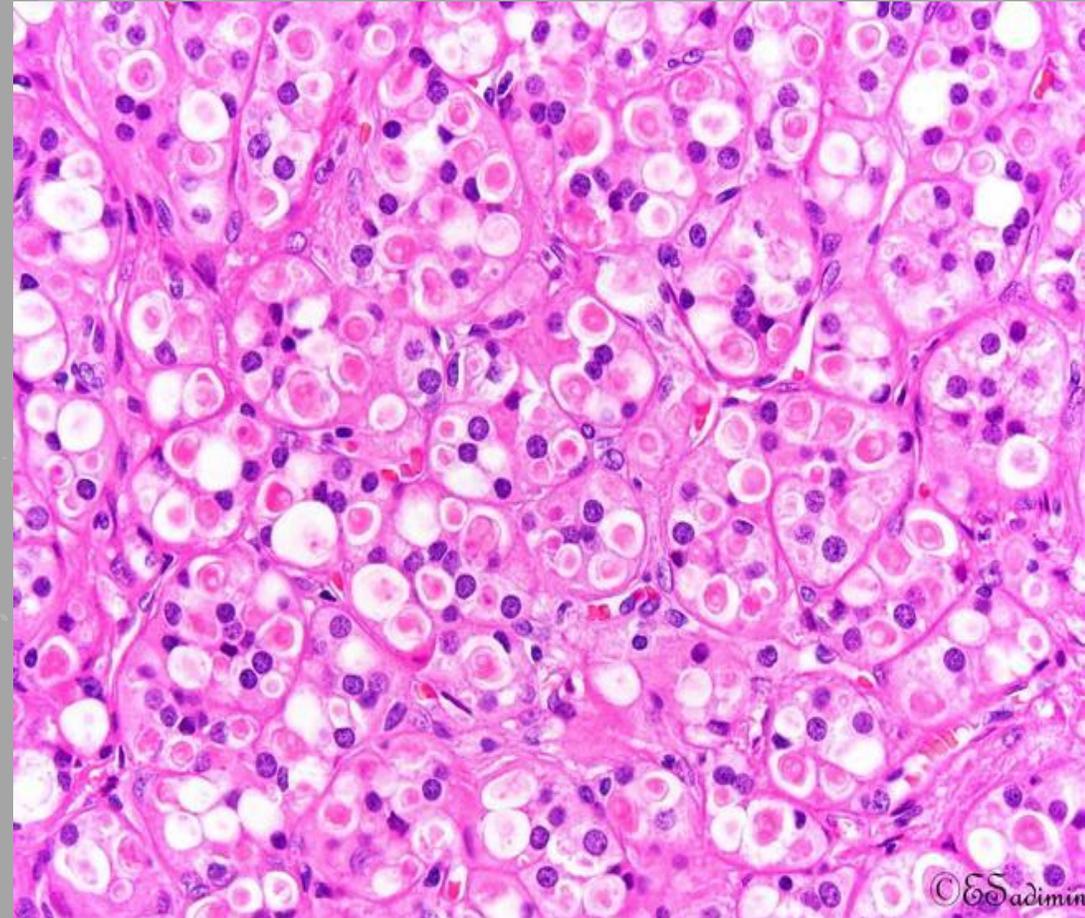


+ hirsutism  
+ menstrual abnormalities.  
+ psychiatric symptoms  
+ In pituitary Cushing syndrome or ectopic ACTH secretion ass+/- w skin pigmentation 2ndary to melanocyte-stimulating activity in the ACTH precursor molecule.

# Primary hyperaldosteronism : Adrenocortical neoplasm

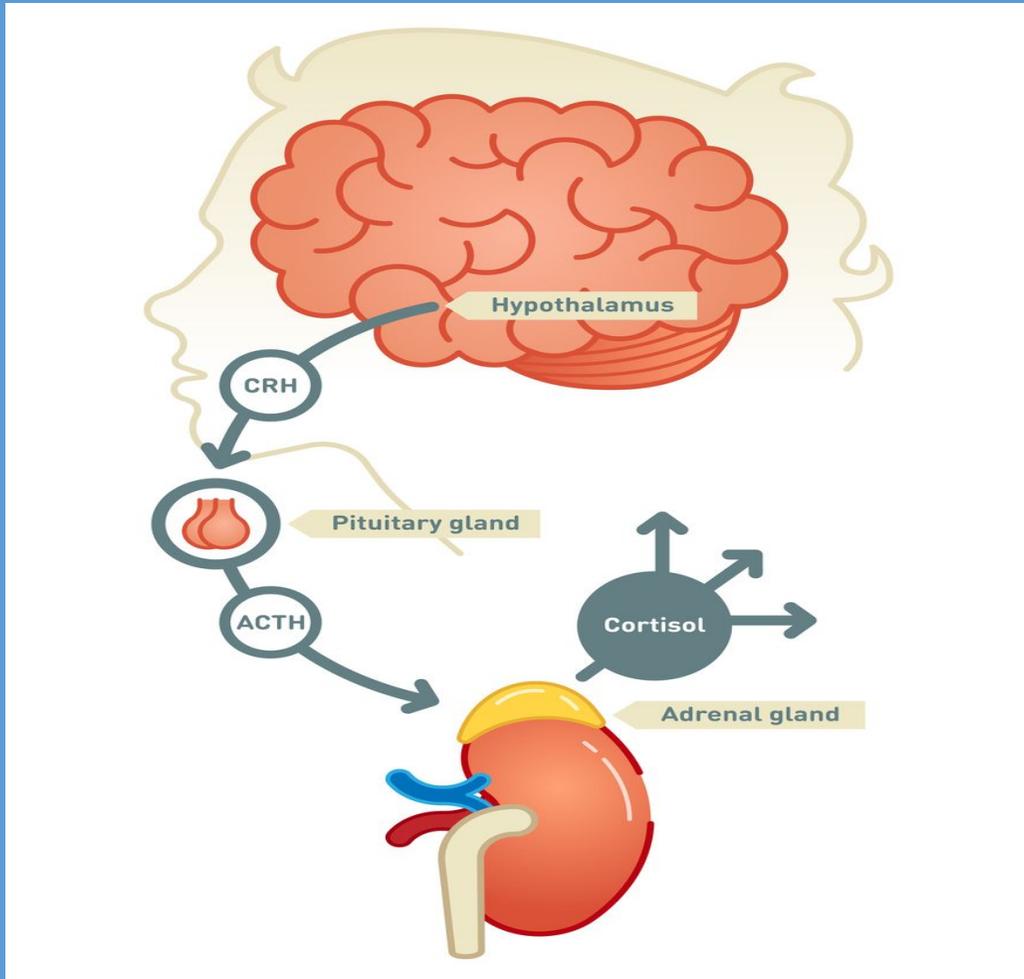
**hypertension and  
hypokalemia  
due adenoma carcinoma  
,familial hyper alostronims**

- Solitary, small (<2 cm)
- Composed of lipid-laden cells more resembling fasciculata cells than glomerulosa cells.
- Aldosterone-producing adenomas has eosinophilic, cytoplasmic inclusions (spironolactone bodies) □ treatment with spironolactone (drug of choice in primary hyperaldosteronism)



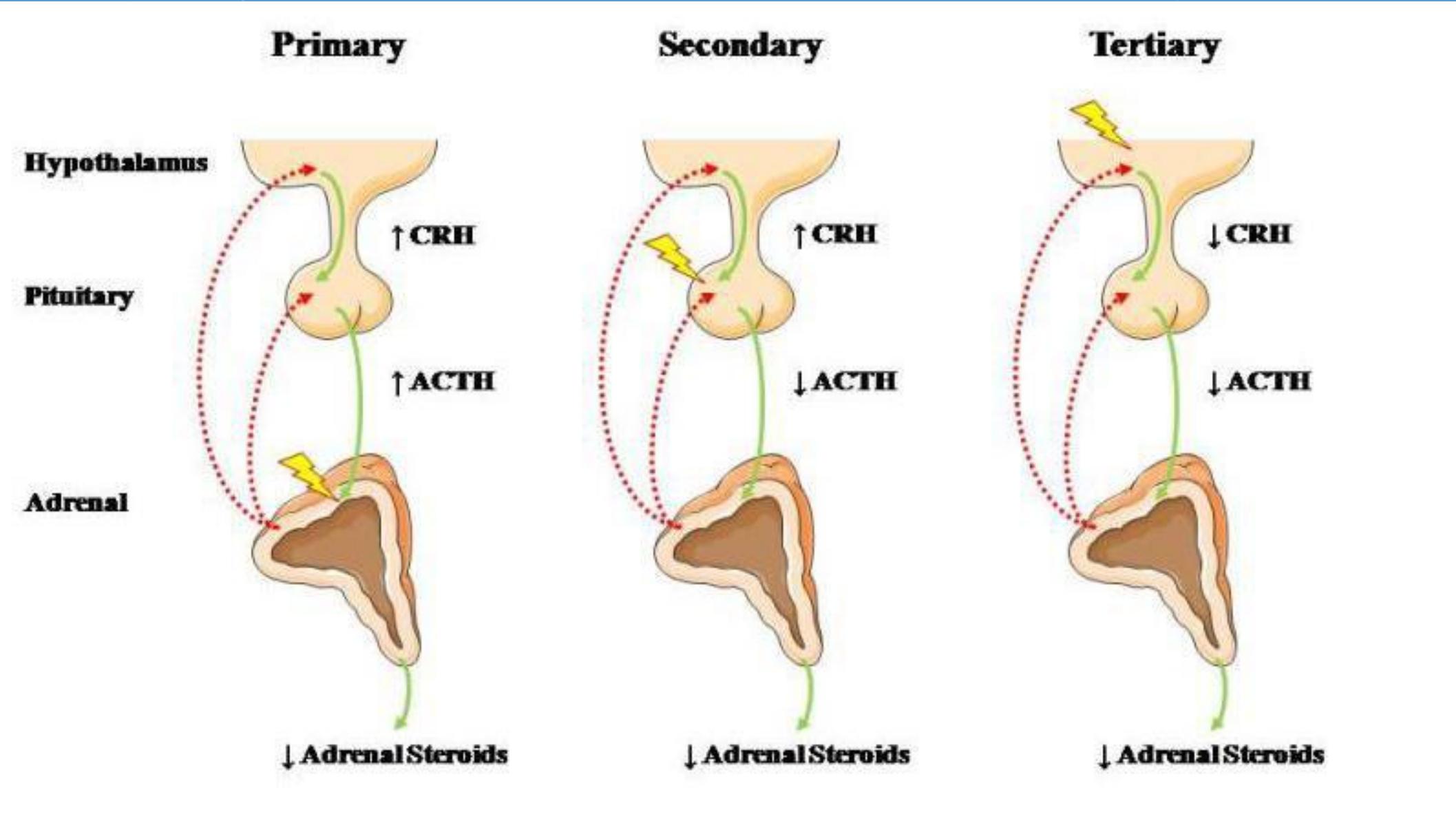
**spironolactone bodies within the adenoma it the metabolite of drug (spiolactone >>> diuritic drug)**

# ADRENOCORTICAL INSUFFICIENCY



- Caused by either primary adrenal disease (primary hypoadrenalism) or decreased stimulation resulting from ACTH deficiency (secondary hypoadrenalism).
- Primary adrenocortical insufficiency may be:
  1. *Acute (called adrenal crisis)*
  2. *chronic (Addison disease)*

exogenous  
cortisol



## Acute

Waterhouse-Friderichsen syndrome

Sudden withdrawal of long-term corticosteroid therapy

Stress in patients with underlying chronic adrenal insufficiency

### Three clinical settings:

1. Individuals with chronic adrenocortical insufficiency may develop an acute crisis after stress that taxes their limited physiologic reserves.

2. Patients maintained on exogenous corticosteroids after rapid withdrawal of steroids □ inability of the atrophic adrenals to produce glucocorticoids.

01

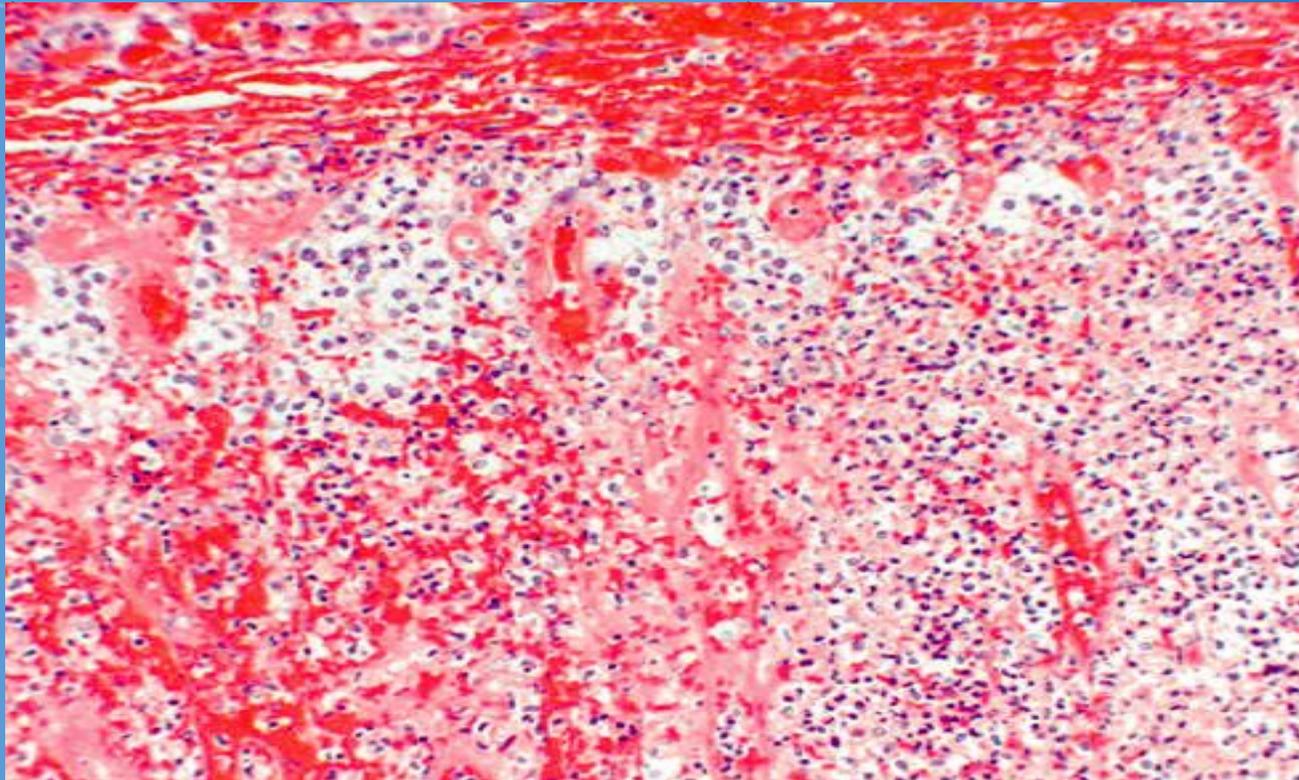
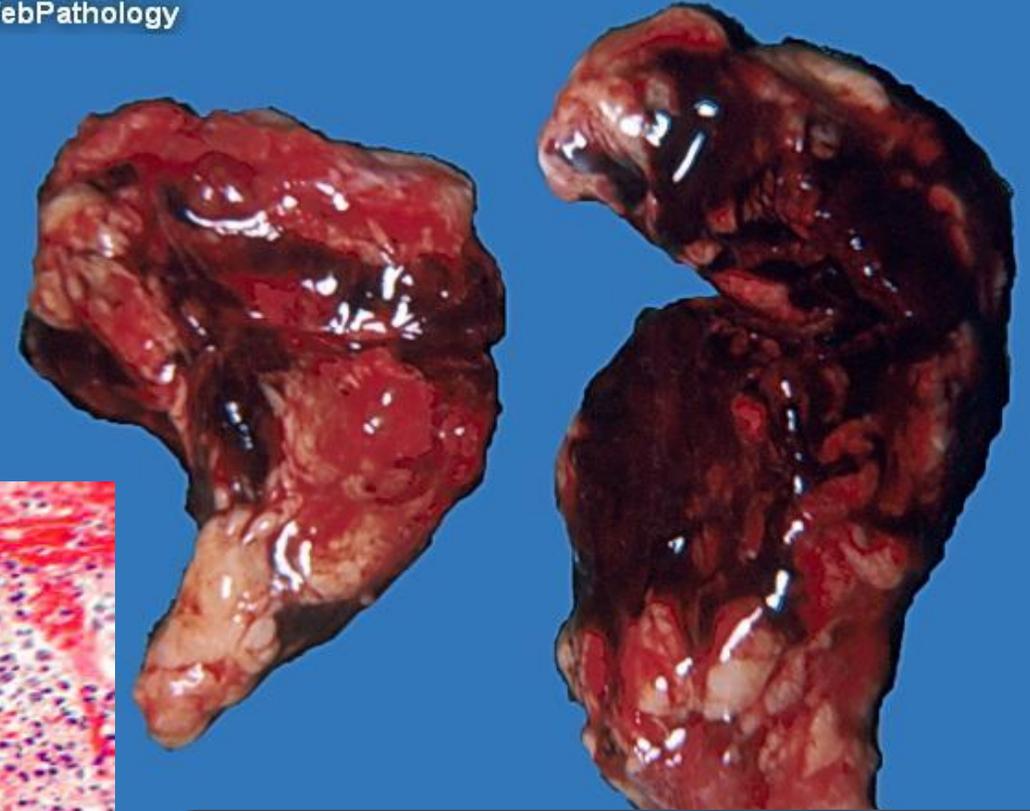
# Adrenal Crisis

Acute adrenocortical  
Insufficiency

# Waterhouse Friderichsen syndrome

increase or decrease in cortisol the early symptoms of both is weakness and fatigue

©WebPathology



active in children but may be seen in any age will make sepsis (bacteria in blood) induce DIC hemorrhage and coagulation at same time in multiple organ this will lead to waterhouse friderichsen syndrome if affected adrenal cortex the endotoxin of bacteria induce hemorrhage and clotting inside adrenal  
>>>>hemorrhagic necrosis >>>bilateral>>acute adrenal crisis



# Adrenal Medulla



**Distinct from the cortex. It is cells derived from the neural crest**



**Populated by chromaffin cells & their supporting sustentacular cells.**



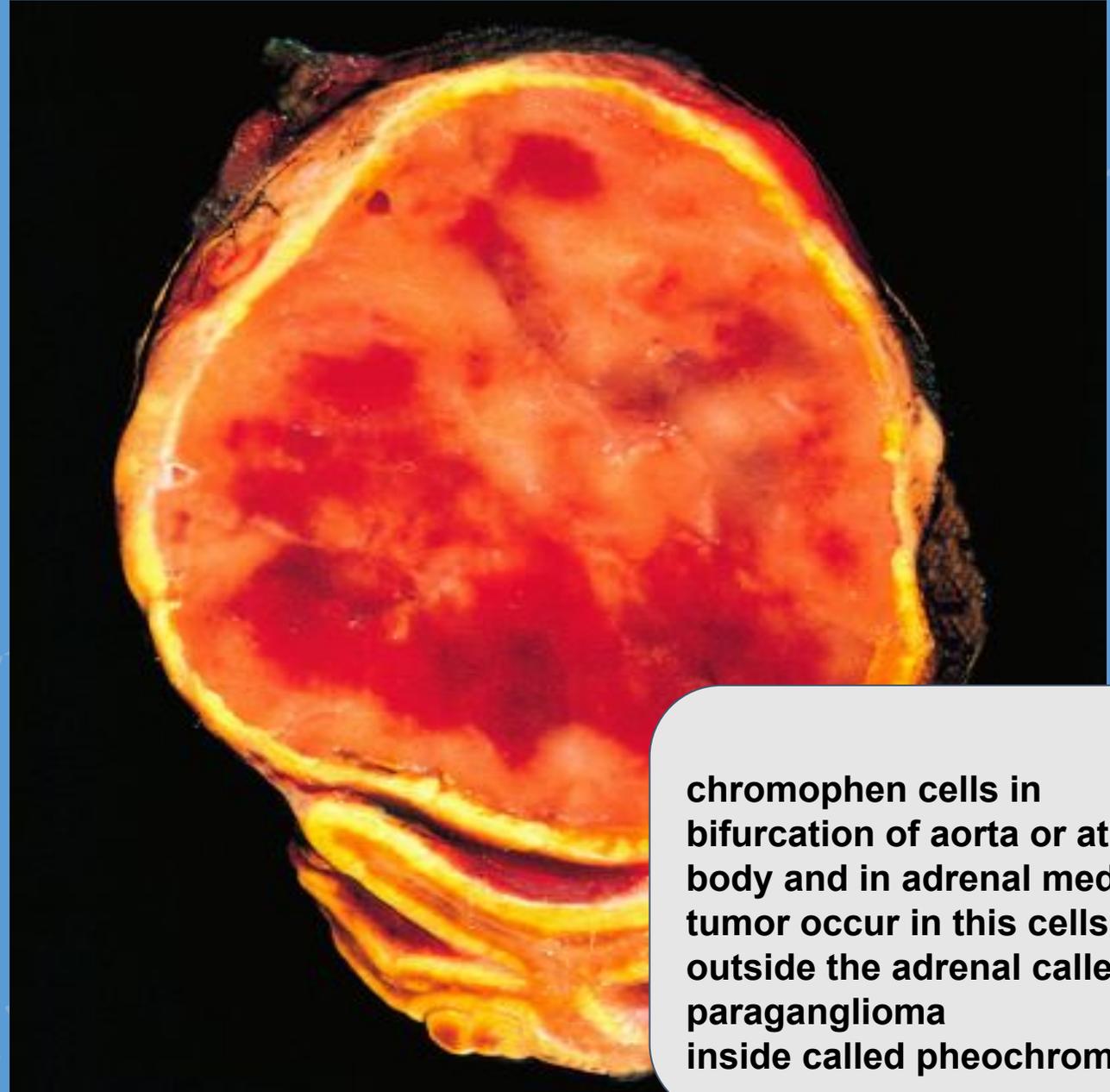
**Synthesize & secrete catecholamines in response to signals from sympathetic nervous system**

# Pheochromocytoma

## Grossly:

Can be small, circumscribed lesions or large, hemorrhagic masses weighing several kilograms.

On cut surface, smaller lesions are yellow-tan. Larger lesions tend to be hemorrhagic, necrotic.



chromophen cells in bifurcation of aorta or at carotid body and in adrenal medulla tumor occur in this cells , if it outside the adrenal called paraganglioma inside called pheochromocytoma

# Pheochromocytoma

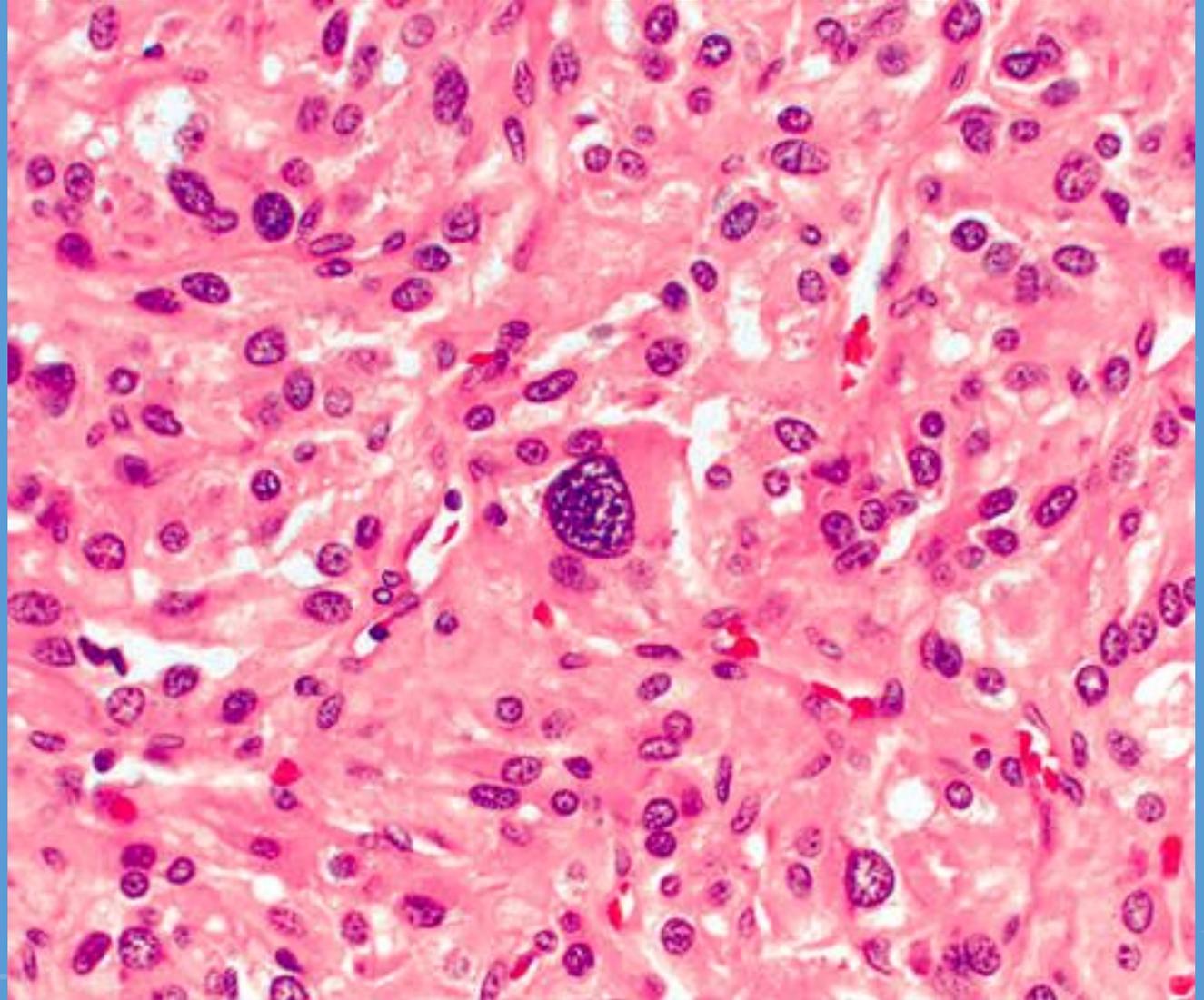
## Microscopically:

composed of polygonal to spindle chromaffin cells & their supporting cells, compartmentalized into small nests, by a rich vascular network.

Cytoplasm has a finely granular appearance

□ presence of catecholamines granules

Nuclei are often pleomorphic.



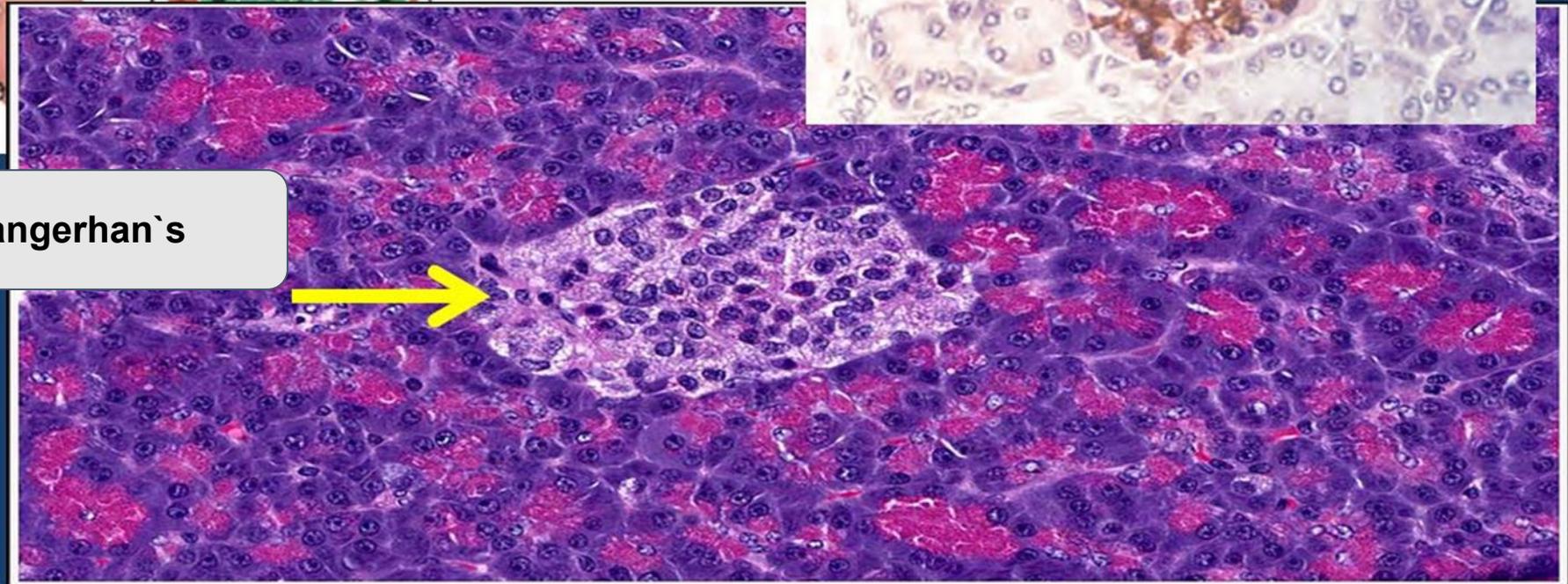
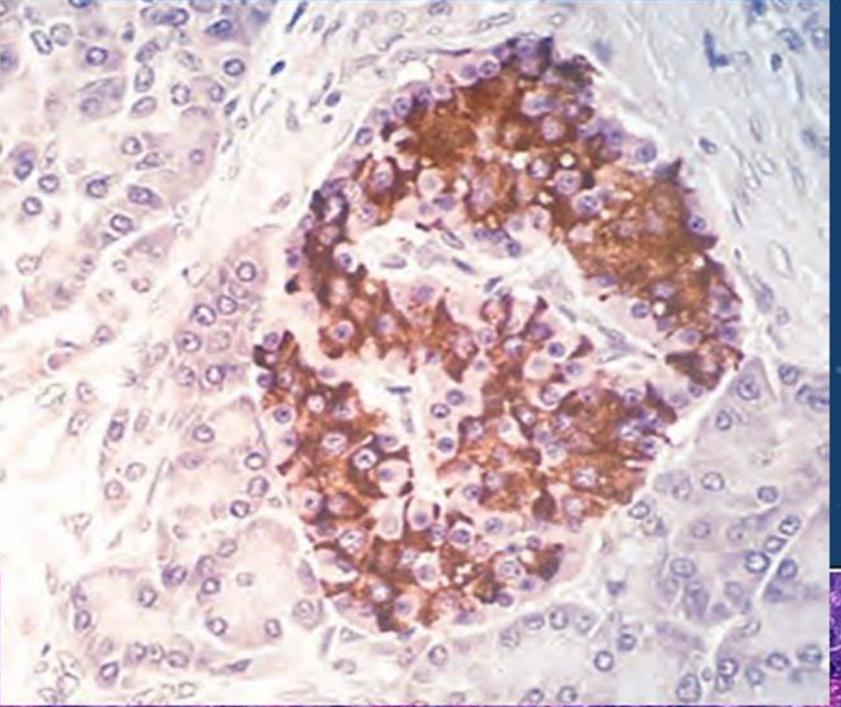
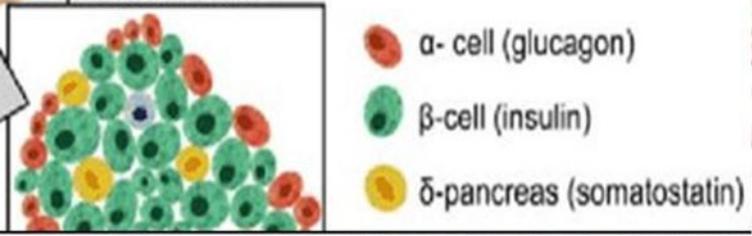
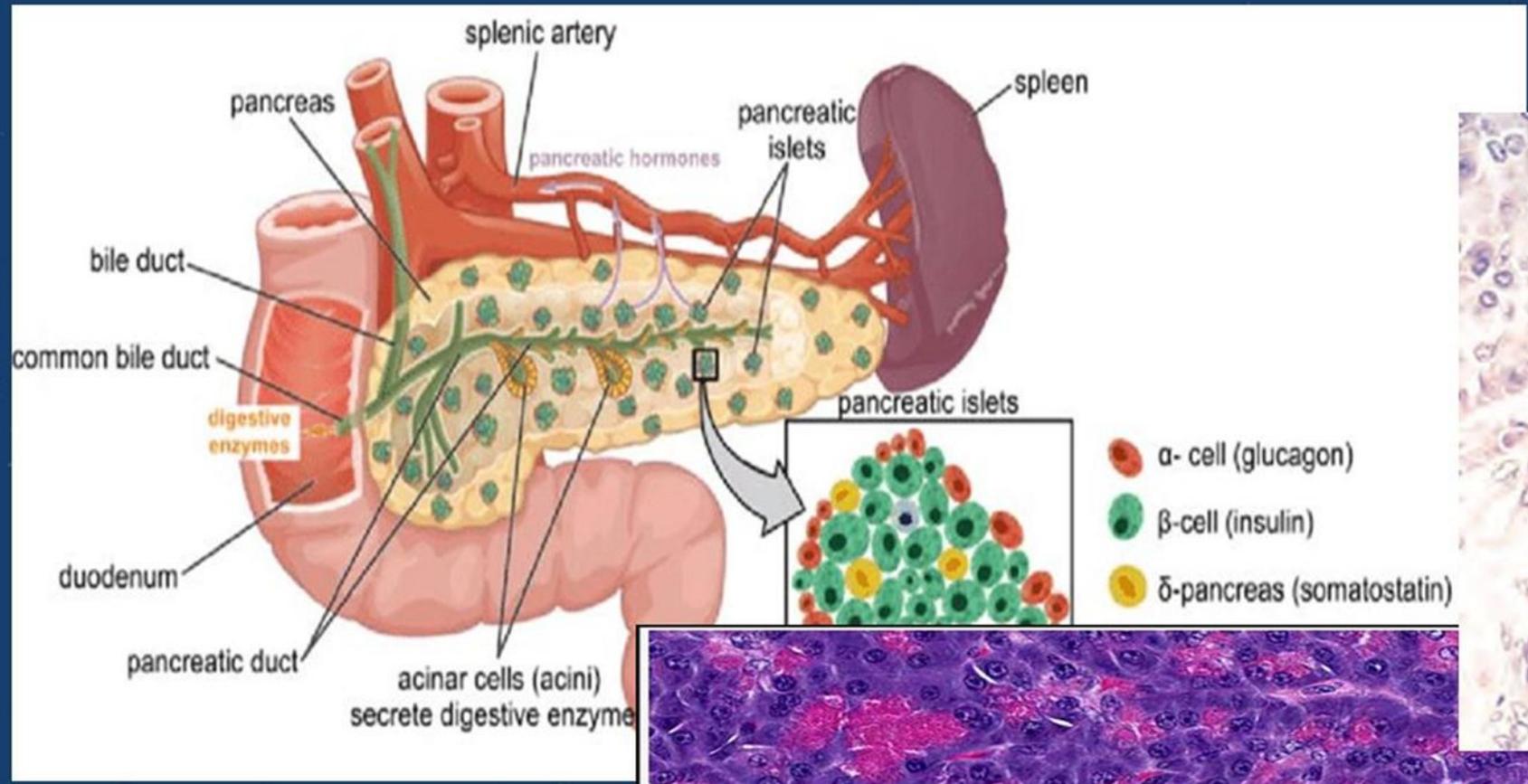


# Diabetes mellitus

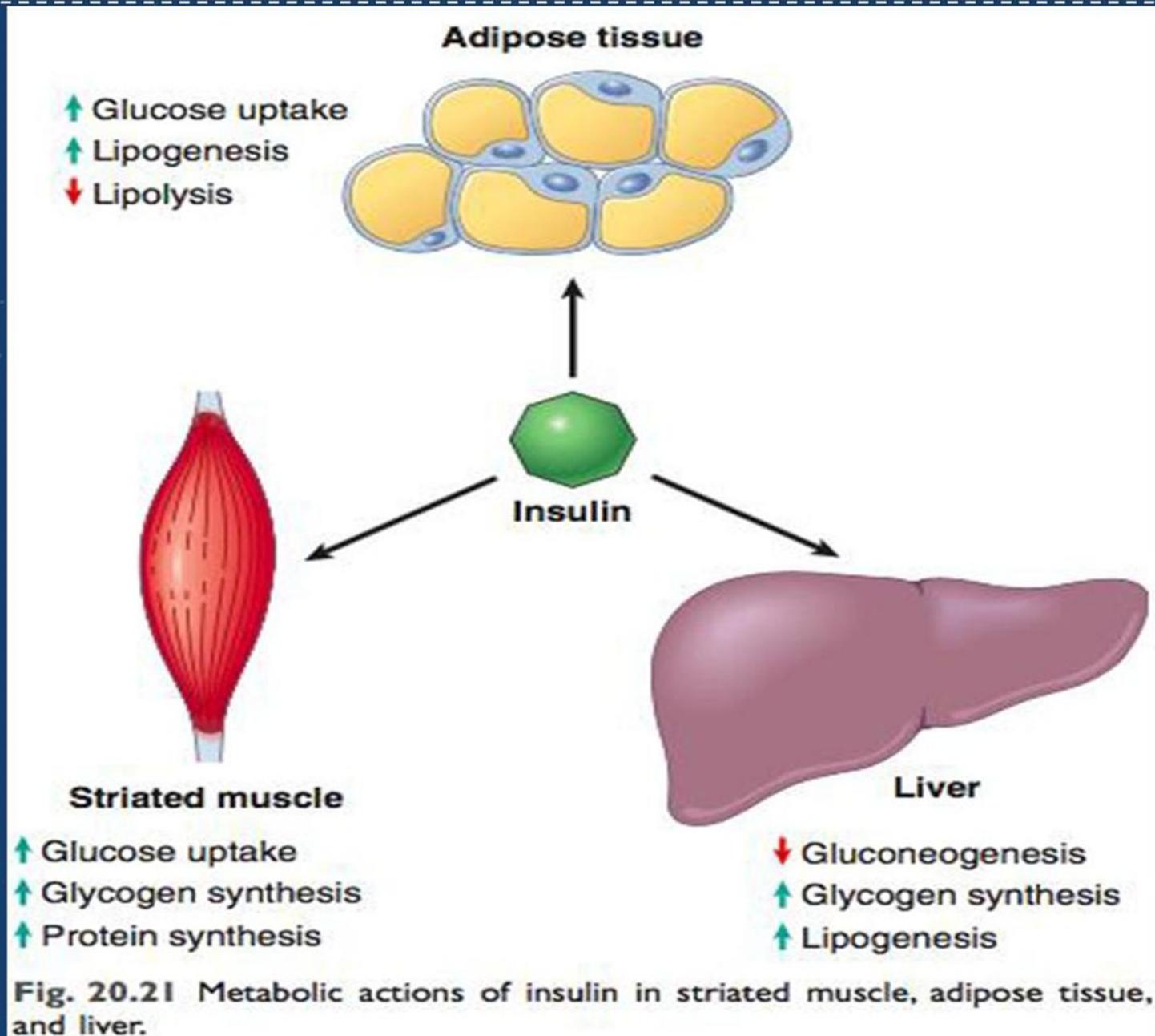
A group of metabolic disorders sharing  
the common feature of hyperglycemia

GHADEER HAYEL, MD

APRIL 28<sup>TH</sup> 2021



islet of langerhan`s

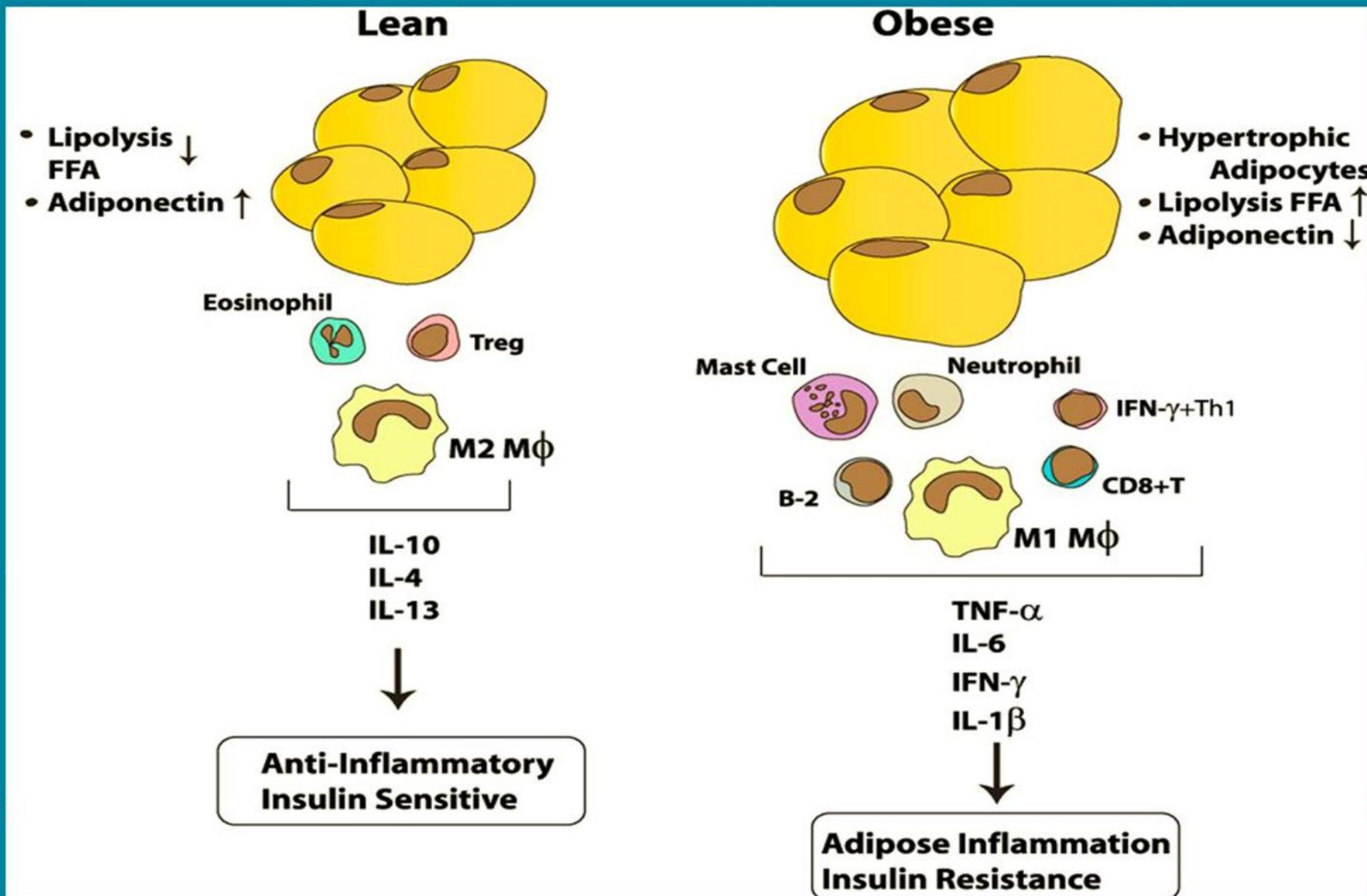


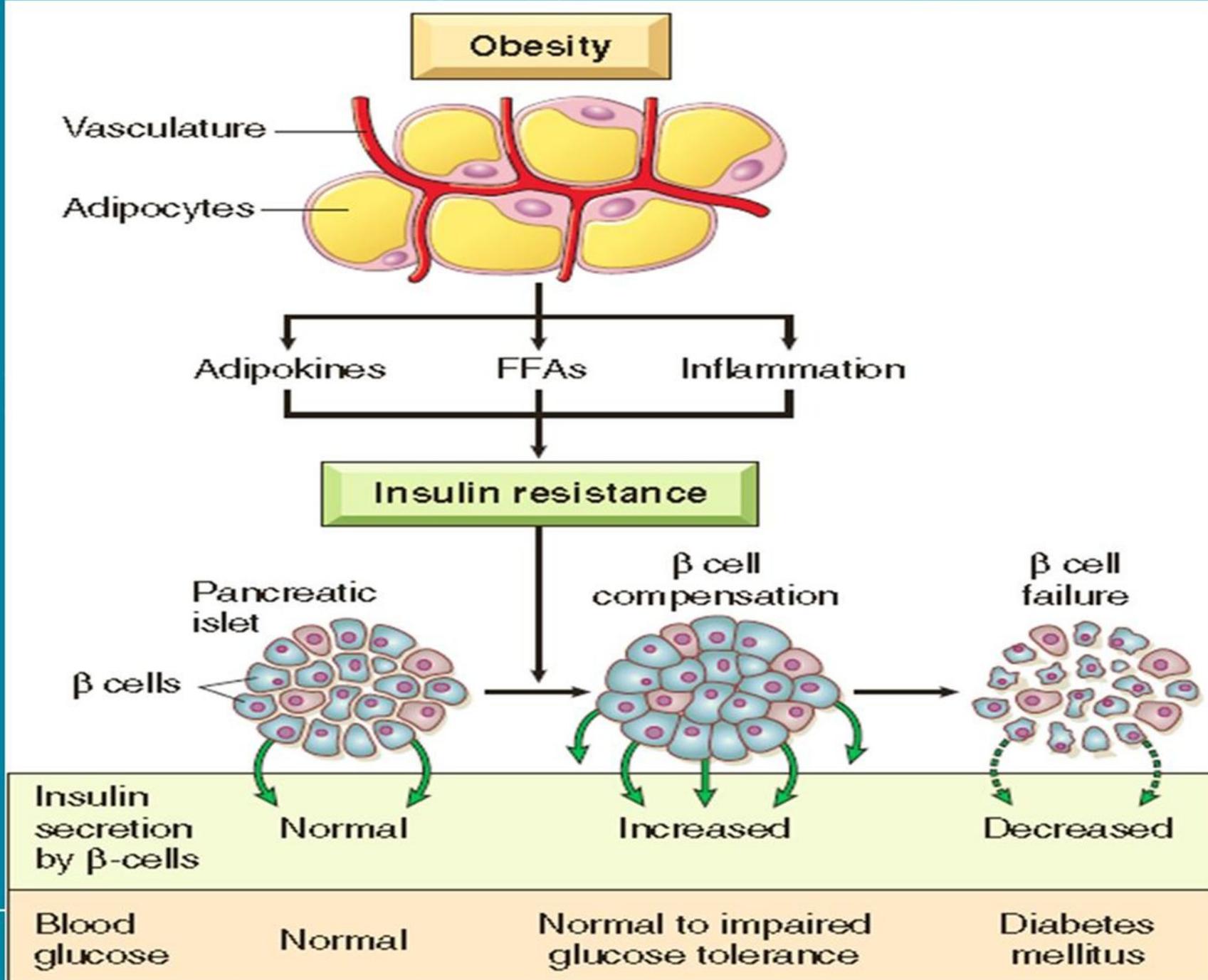
The principal function of insulin is to increase the rate of glucose transport into certain cells in the body.

Metabolic effects of insulin → anabolic:

- Increased synthesis & reduced degradation of glycogen, lipid, & protein.
- Initiation of DNA synthesis in certain cells → Stimulating their growth & differentiation.

# Obesity and insulin resistance



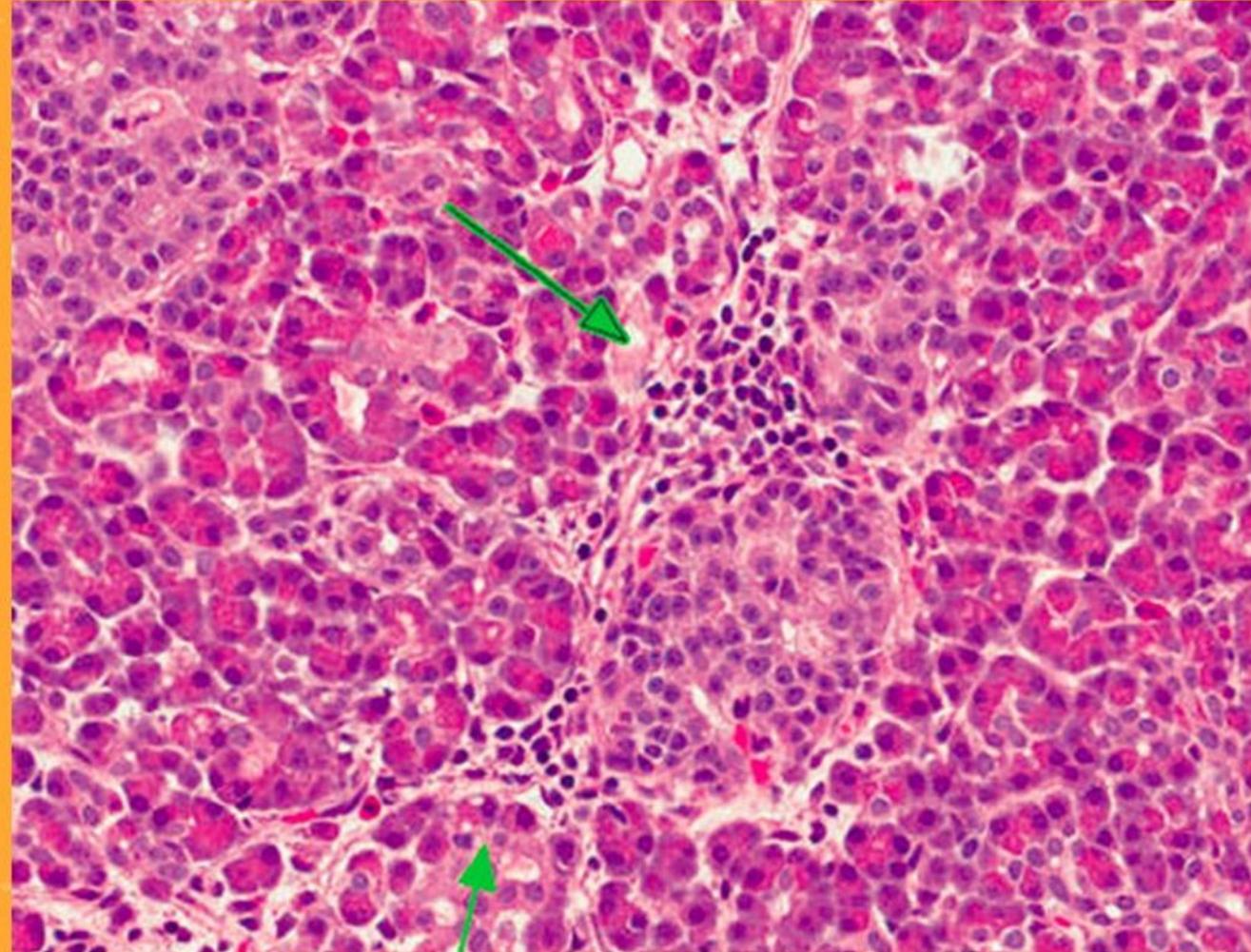


# Morphology - Pancreas

autoimmunedisease

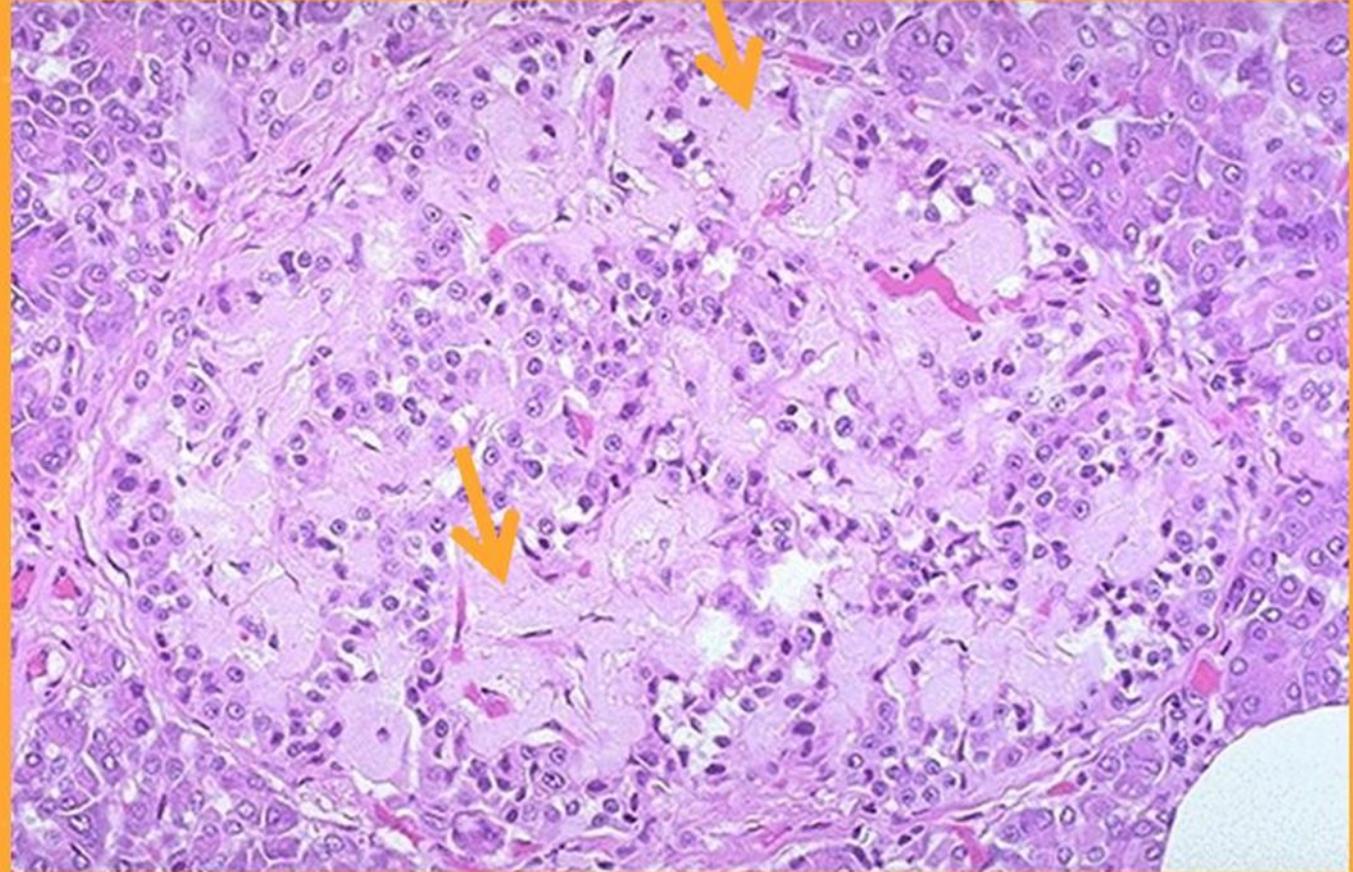
بالبدايه يتم تحطيم كل الخلايا بعد هيك بس بصير  
تحطيم لل beta cells

- **Reduction in the number and size of islets.** Mostly in type 1 diabetes, islets are small, inconspicuous, & not easily detected.
- **Leukocytic infiltrates in the islets (insulinitis)** are principally composed of T lymphocytes. Seen in type 1 diabetes at the time of clinical presentation.



# Morphology - Pancreas

- **Amyloid deposition within islets in type 2 diabetes** begins in & around capillaries and between cells. At advanced stages. Similar lesions may be found in older non-diabetics, apparently as part of normal aging.



extra or intracellular material from blood it immuno materias and immunoglobulins

# Chronic Complications of Diabetes

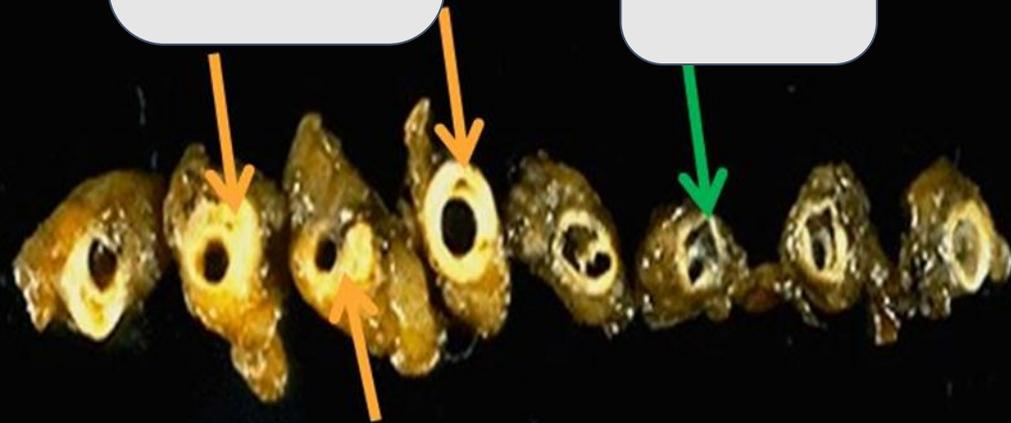


- **Diabetic macrovascular disease:**

1. Accelerated **atherosclerosis**, more severe & earlier onset in DM.
2. **Myocardial infarction**, caused by atherosclerosis of the coronary arteries, is the most common cause of death in diabetics.
3. **Gangrene** of the lower extremities: 100 times more common in diabetics than in the general population .

atherosclerosis

normal  
vessle



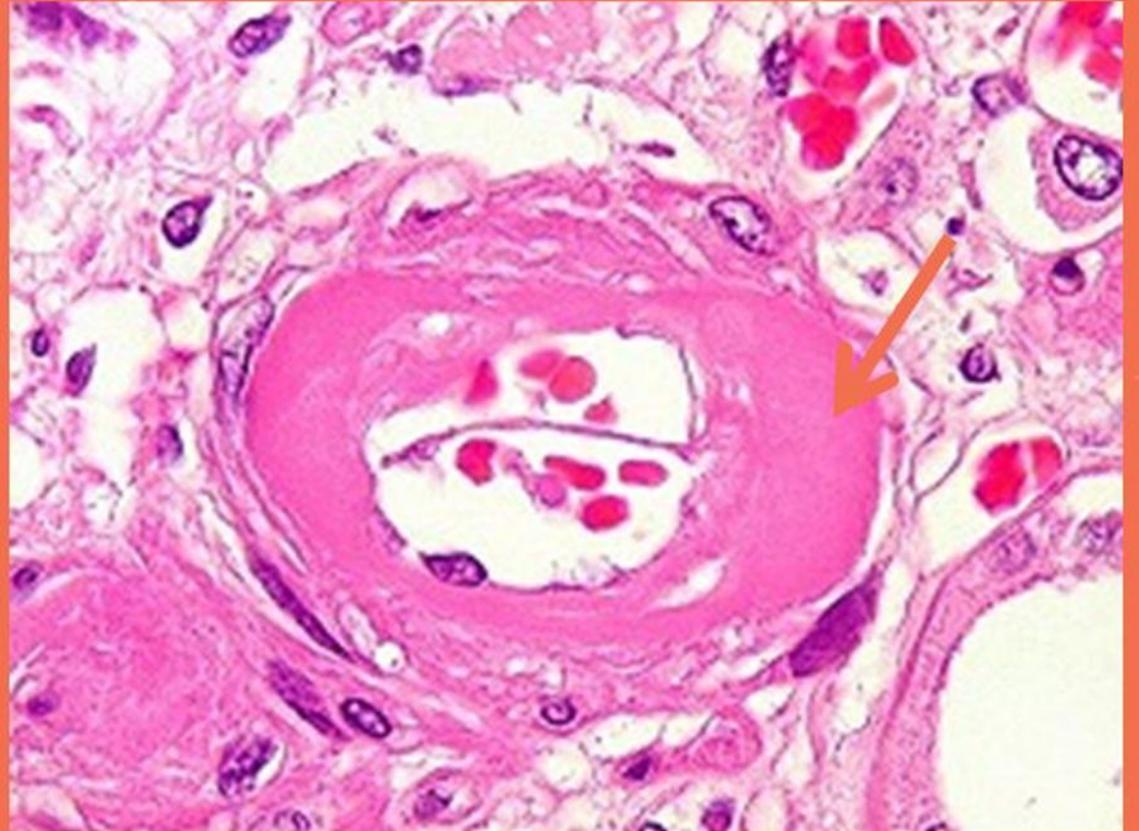
coronary arteries >>> MI

chronic ulcer  
>> no healing



# Chronic Complications of Diabetes

- **Hyaline arteriolosclerosis:** a vascular lesion associated with hypertension, hyaline thickening of the wall of the arterioles.
- both more prevalent & more severe in diabetics (but not specific).



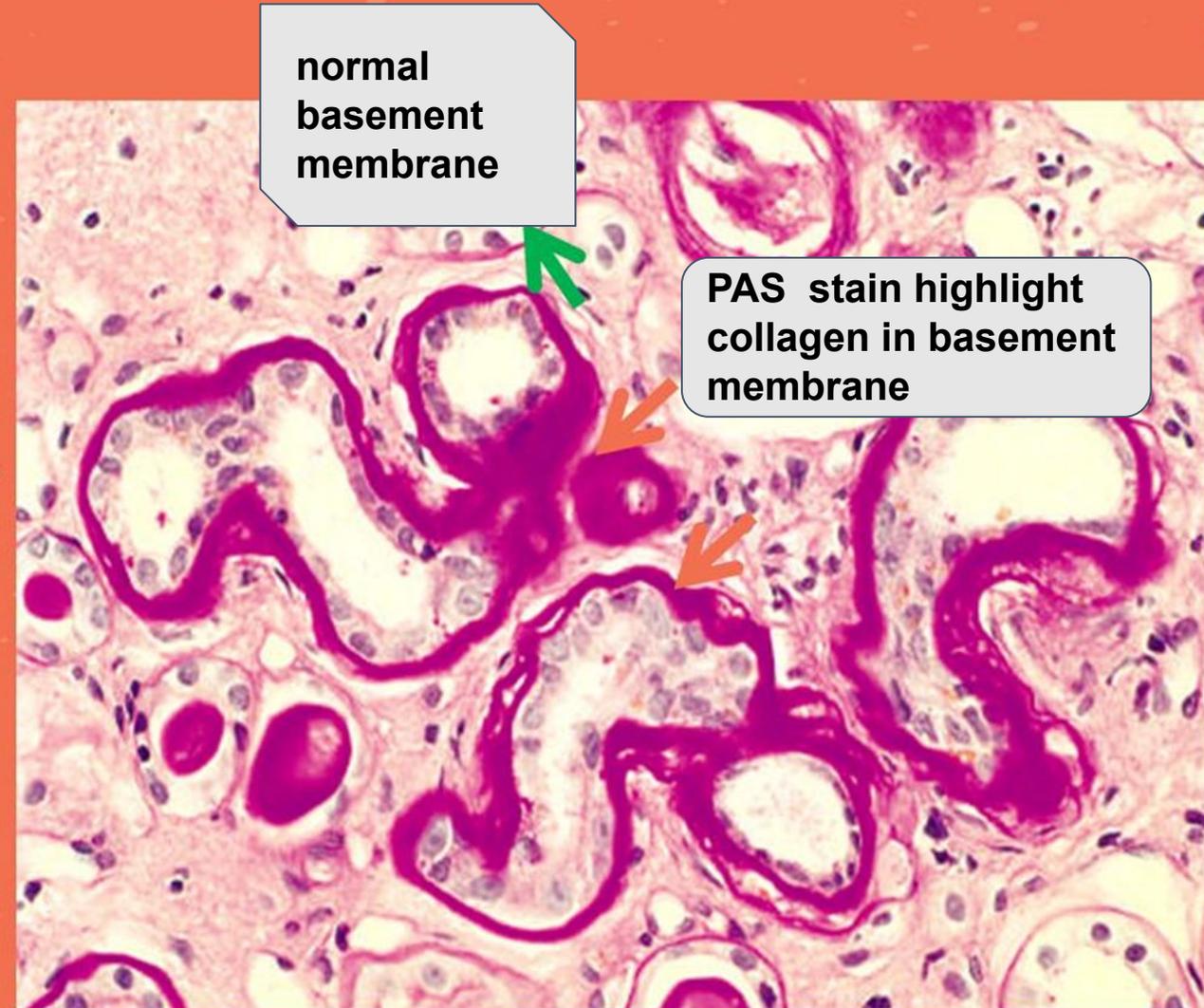
# Chronic Complications of Diabetes

- **Diabetic Microangiopathy**

Diffuse thickening of basement membranes.

- Most evident in capillaries of the skin, skeletal muscle, retina & renal glomeruli, also in renal tubules, nerves, & placenta.

- Underlies the development of diabetic nephropathy, retinopathy, & some forms of neuropathy



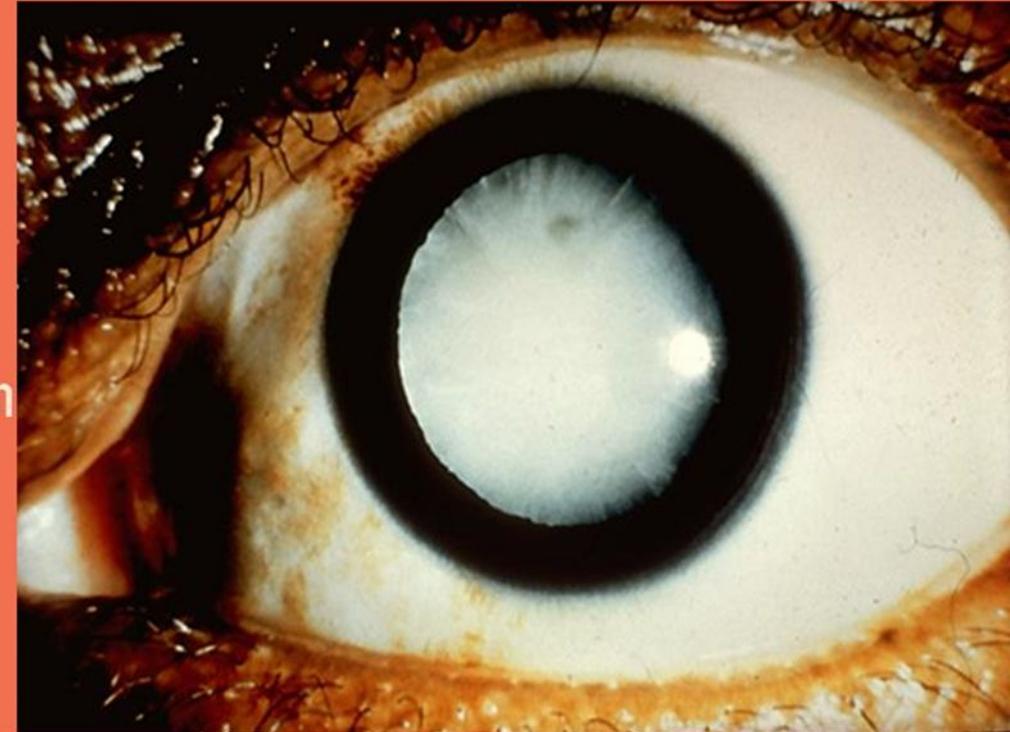
# Chronic Complications of Diabetes



## Diabetic Retinopathy

- Visual impairment & blindness, one of the more feared consequences of long-standing DM. (fourth leading cause of acquired blindness in US)
- 60% - 80% of patients develop a form of diabetic retinopathy in 15 to 20 of diagnosis
- Diabetic patients also have an increased propensity for glaucoma & cataract formation

**due to affect lens**



**edited by : Batool Gharaibeh**