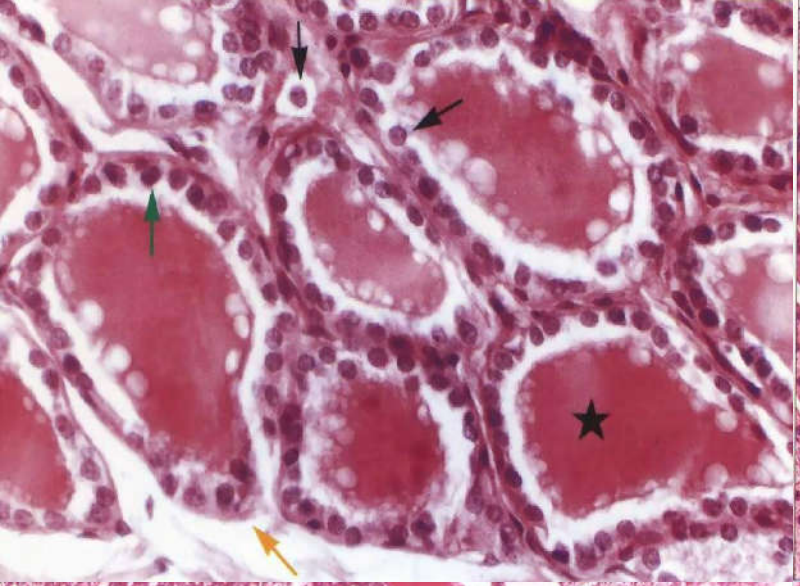
Endocrine System

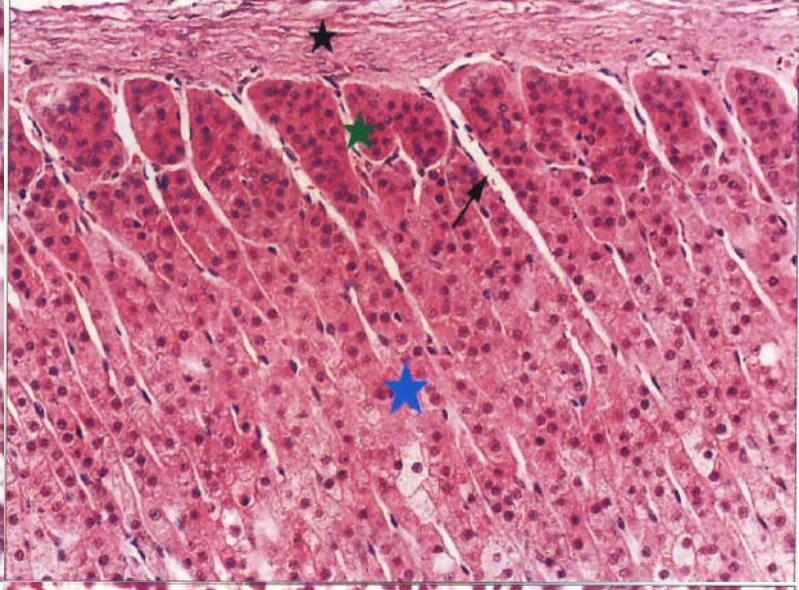
四川大学组织学与胚胎学教研室

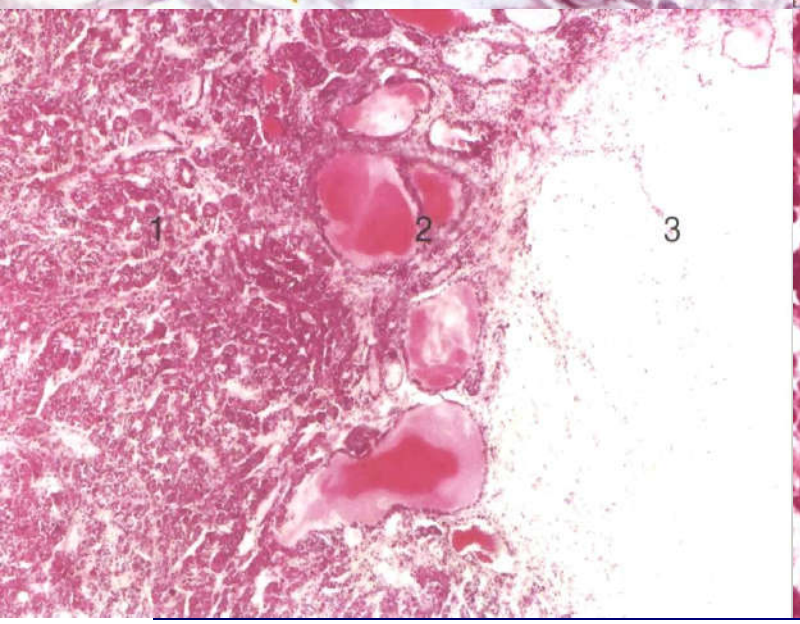
- general characteristics
- thyroid gland
- parathyroid gland
- adrenal gland
- hypophysis

I. General characteristics

- glandular cells: cords, clusters, follicles, or reticula.
- have no duct, rich in cap.



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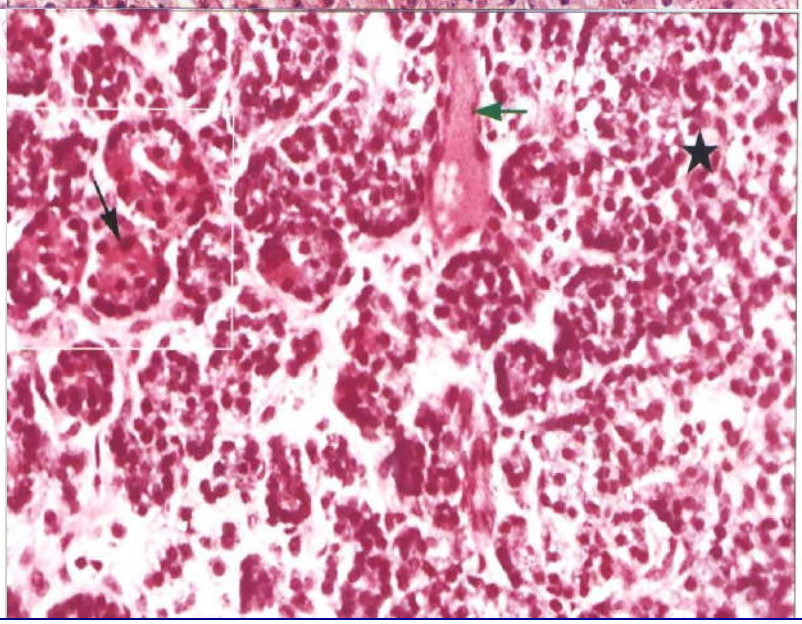


- hormones:

* hormones containing nitrogen

  amino acid derivatives, amine, peptides & proteins (RER, Golgi complex, granules)

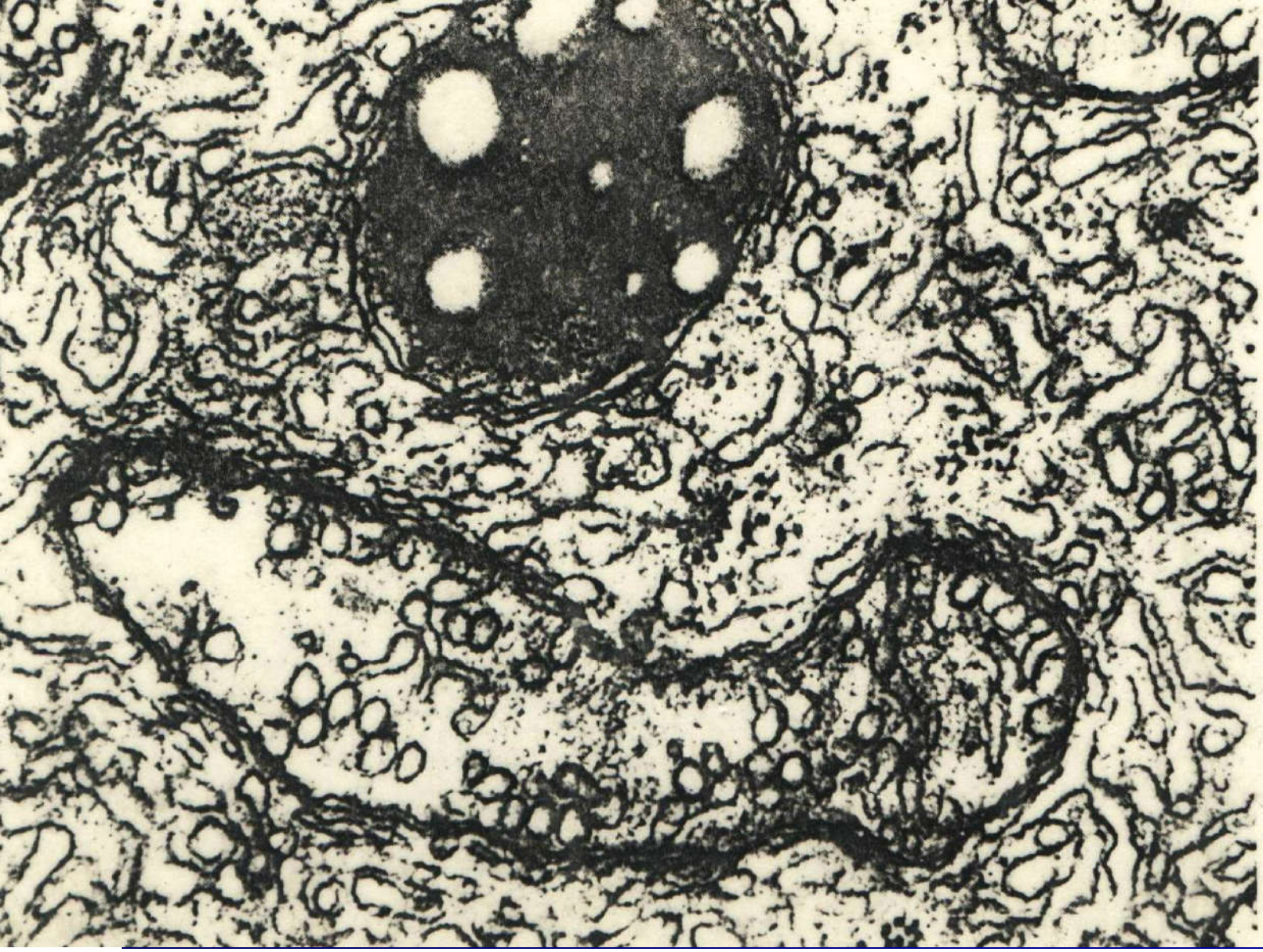
* steroid hormone

  SER, mitochondria with tubular cristae, lipid droplets

- targets (remote or paracrine 旁分泌)

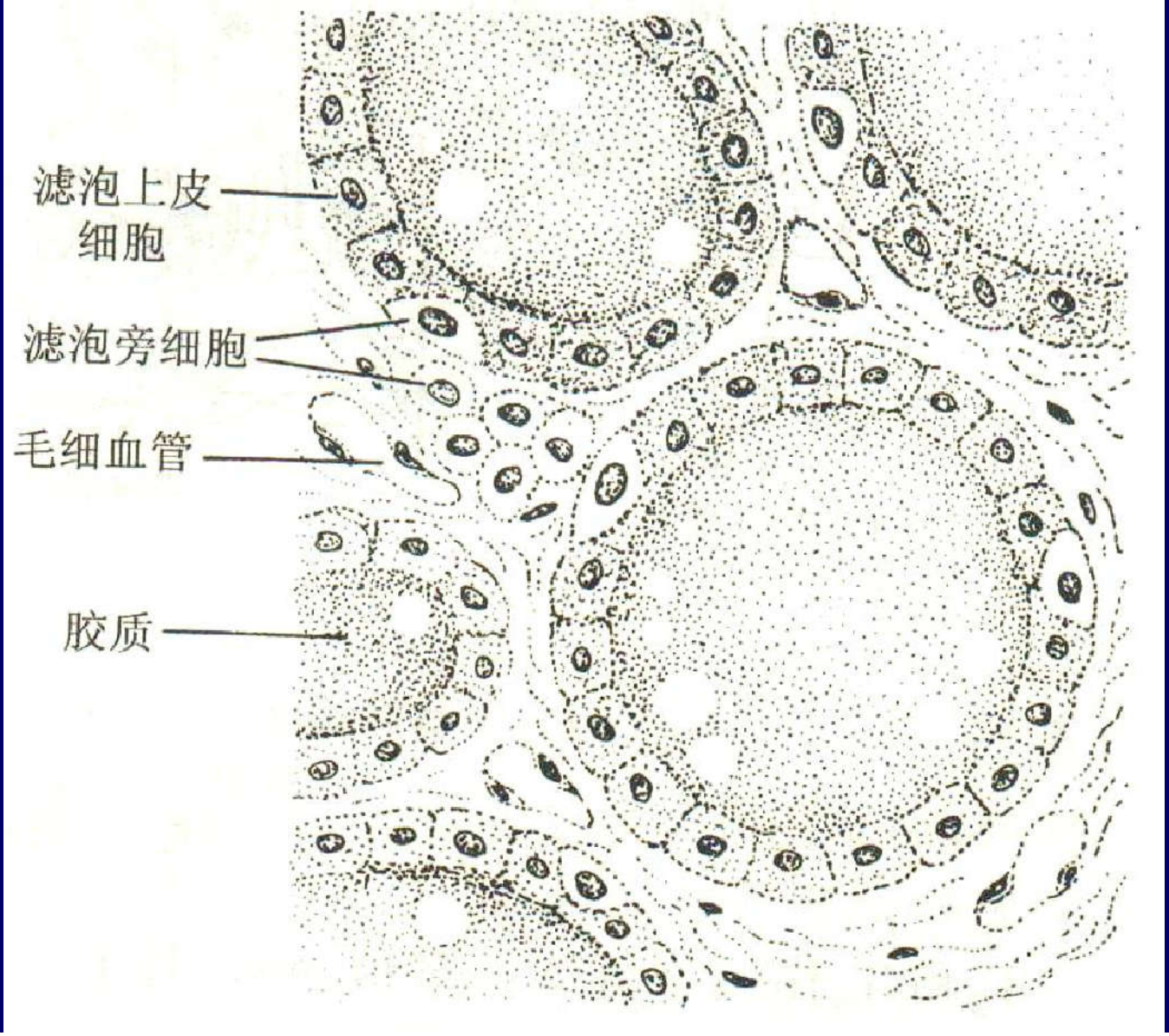
  receptors:

  * nitrogenous hormones ___ in the cell membrane
  * steroid-secreting hormone ___ in the cytoplasm



II. Thyroid

- capsule (LCT)
  - septa
  - rich in cap
- parenchyma: follicles
  - parafollicular cells

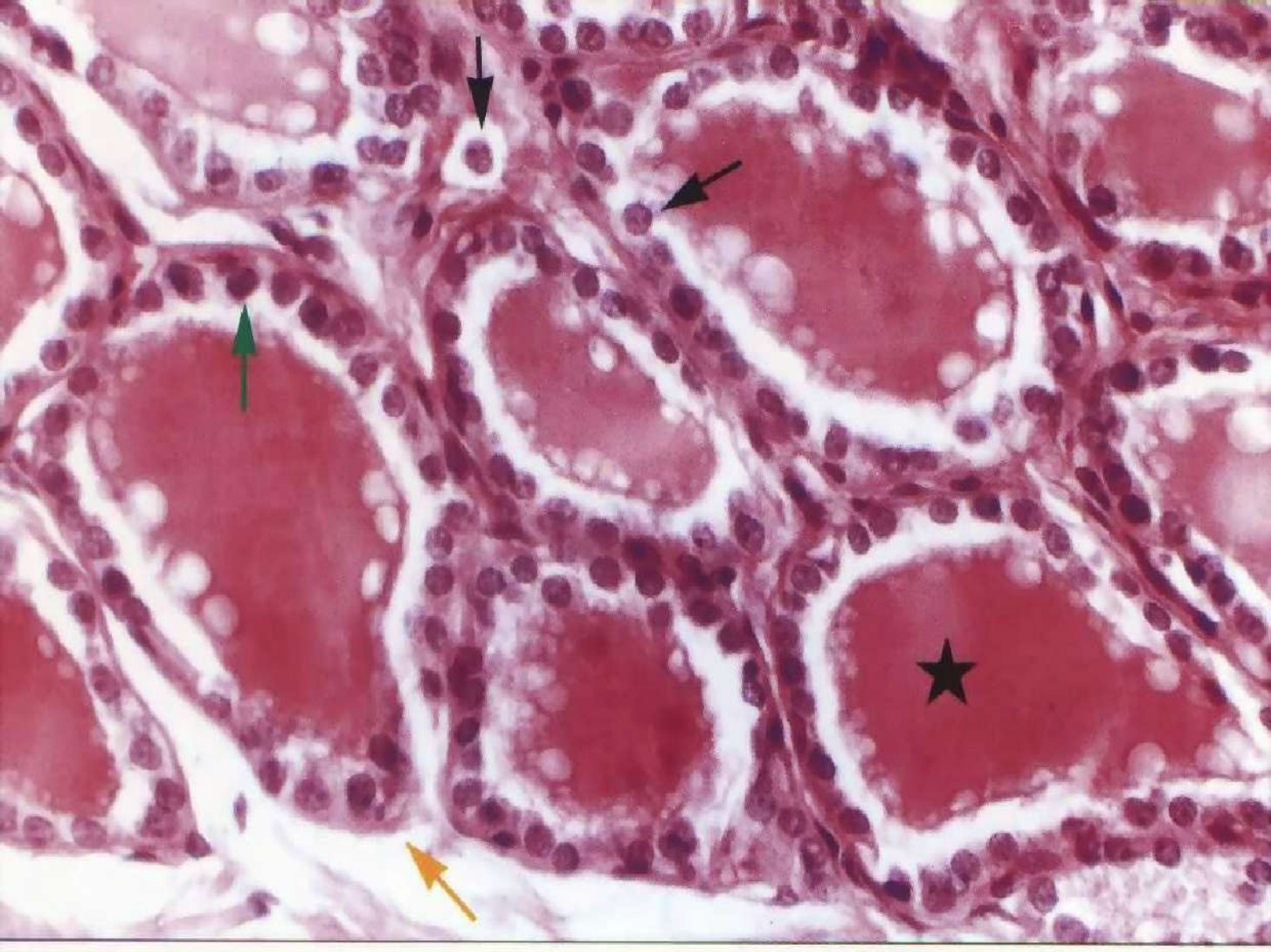

滤泡上皮
细胞
滤泡旁细胞
毛细血管
胶质

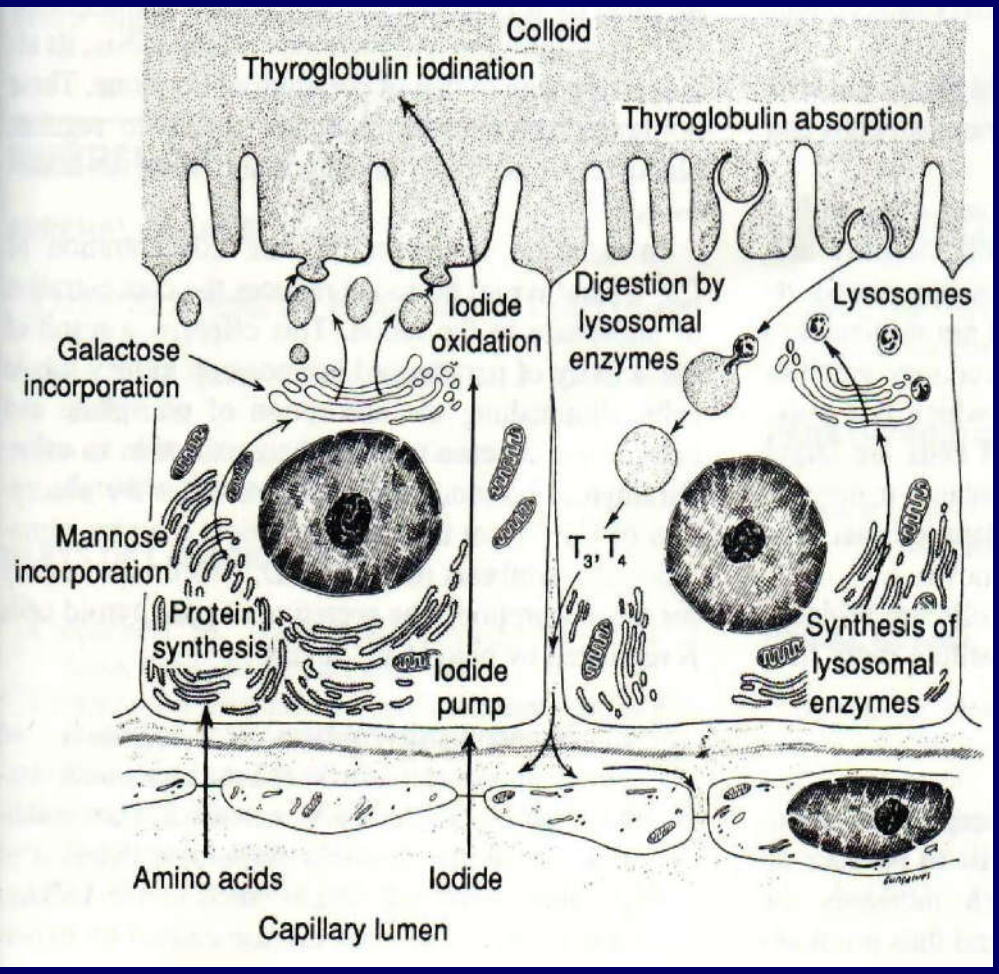
- **Follicles**

  ***simple cuboidal epi**

  (*range from squamous to low columnar*)

  ***colloid 胶质　glycoprotein (acidophilia)**





EM:

microvilli

RER

mitochondria

lysosomes

secretory granules

pinocytic vesicles

fenestrated cap

synthesizing process

- **synthesis of thyroglobulin:**

  amino acids — RER — Golgi complex — vesicles — lumen

- **iodization:**

  I^- —peroxidase→ I_2O → **lumen of follicle**

  → **thyroglobulin iodination (store)**

- **reabsorption & decomposition:**

follicular cells take up colloid by pinocytosis

(stimulated by thyrotropin 促甲状腺激素)

—— lysosomes (proteases) ⟶

T_4 (tetraiodothyronine, thyroxine 甲状腺素)

T_3 (triiodothyronine)

- **releasing:**

  T_4 & T_3 are released into blood —— stimulate the rate of metabolism & development

Abnormal:

* **hypothyroidism**

  cretin (child, 呆小症, poor development of CNS)

  myxedema (adult, 粘液性水肿)

* **hyperthyroidism**

  decreased body weight, nervousness,

  eye protrusion, easy to be tired

  & accelerated heart rate

18 years old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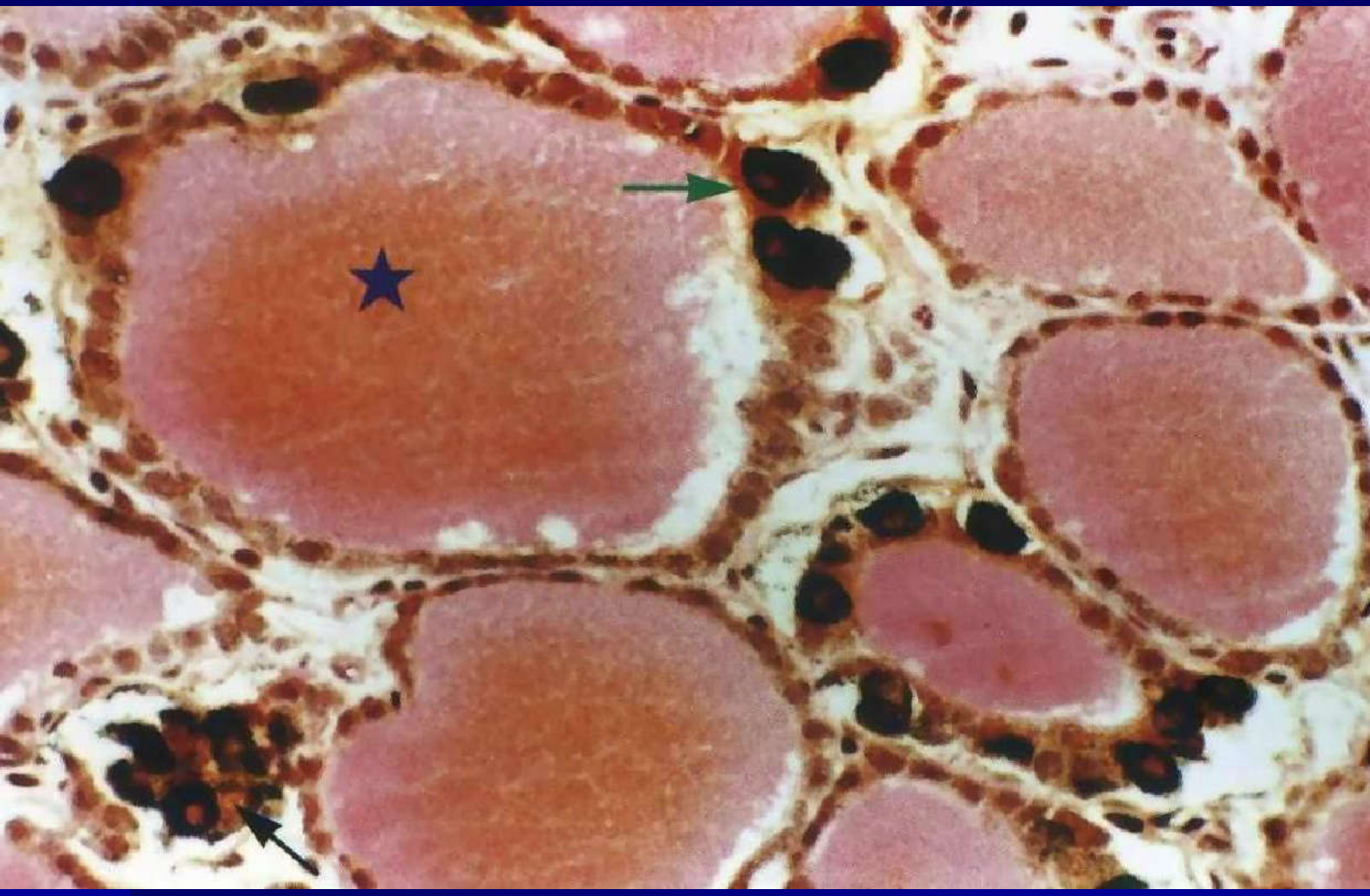
hyperthyroidism eye protrusion

Parafollicular cell

- location: *between follicles in clusters
  *in follicular epithelium
- structure: larger, pale stain, silver stain
  (*argyrophilic granules*)
- secretion: calcitonin 降钙素

*stimulate osteoblasts - new bone

*inhibit absorption of Ca^{+2} —— blood Ca^{+2} ↓



III. Parathyroid gland

glandular cells:

- chief cells (principal cells)

*small polygonal, round nucleus,

pale-staining cytoplasm,

*secretion —— parathyroid hormone

stimulate osteocytes
& osteoclasts

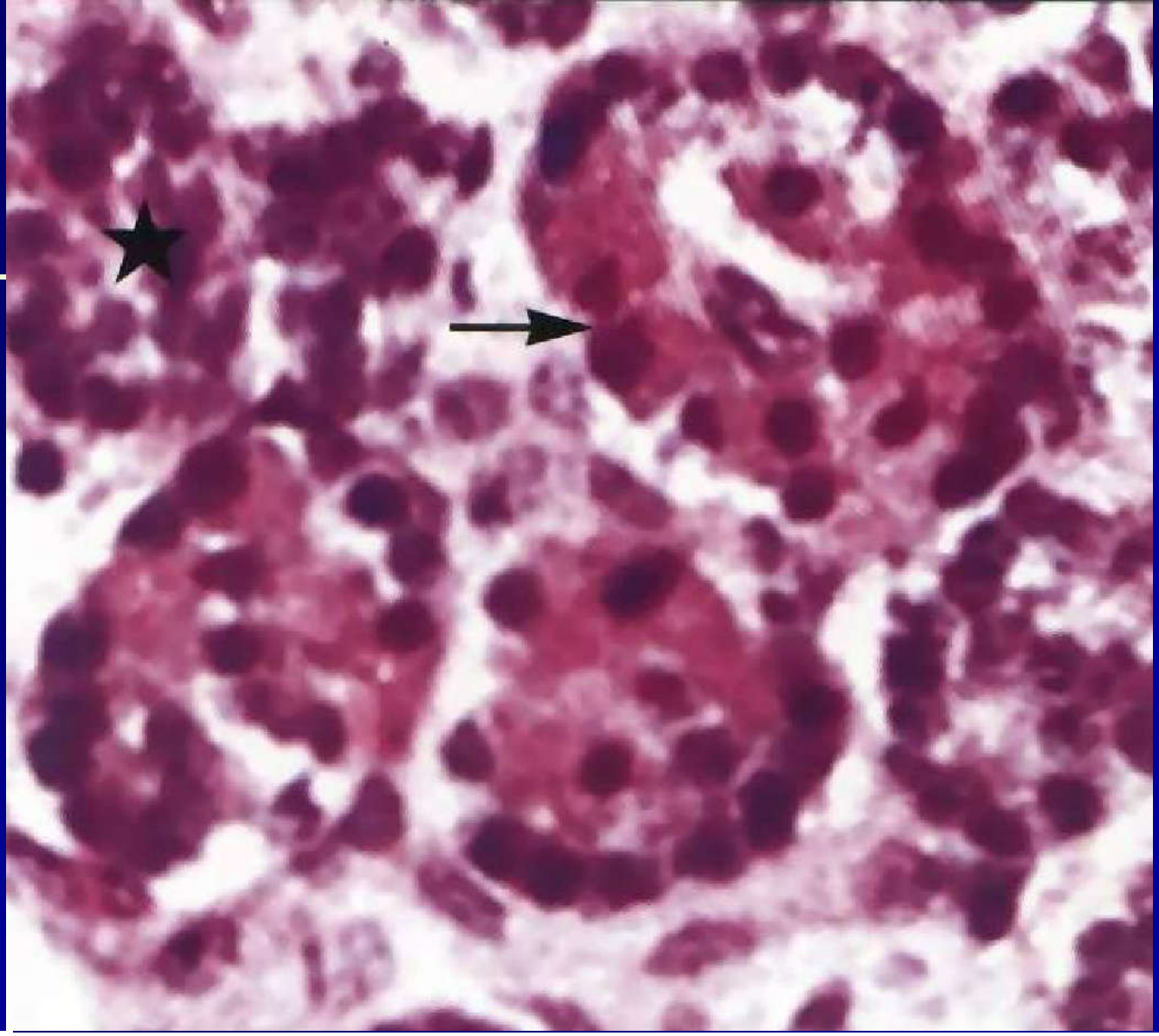
stimulate absorption of Ca^{2+}

blood Ca^{2+} ↑

- oxyphil cells

  mitochondria

  function is not clear

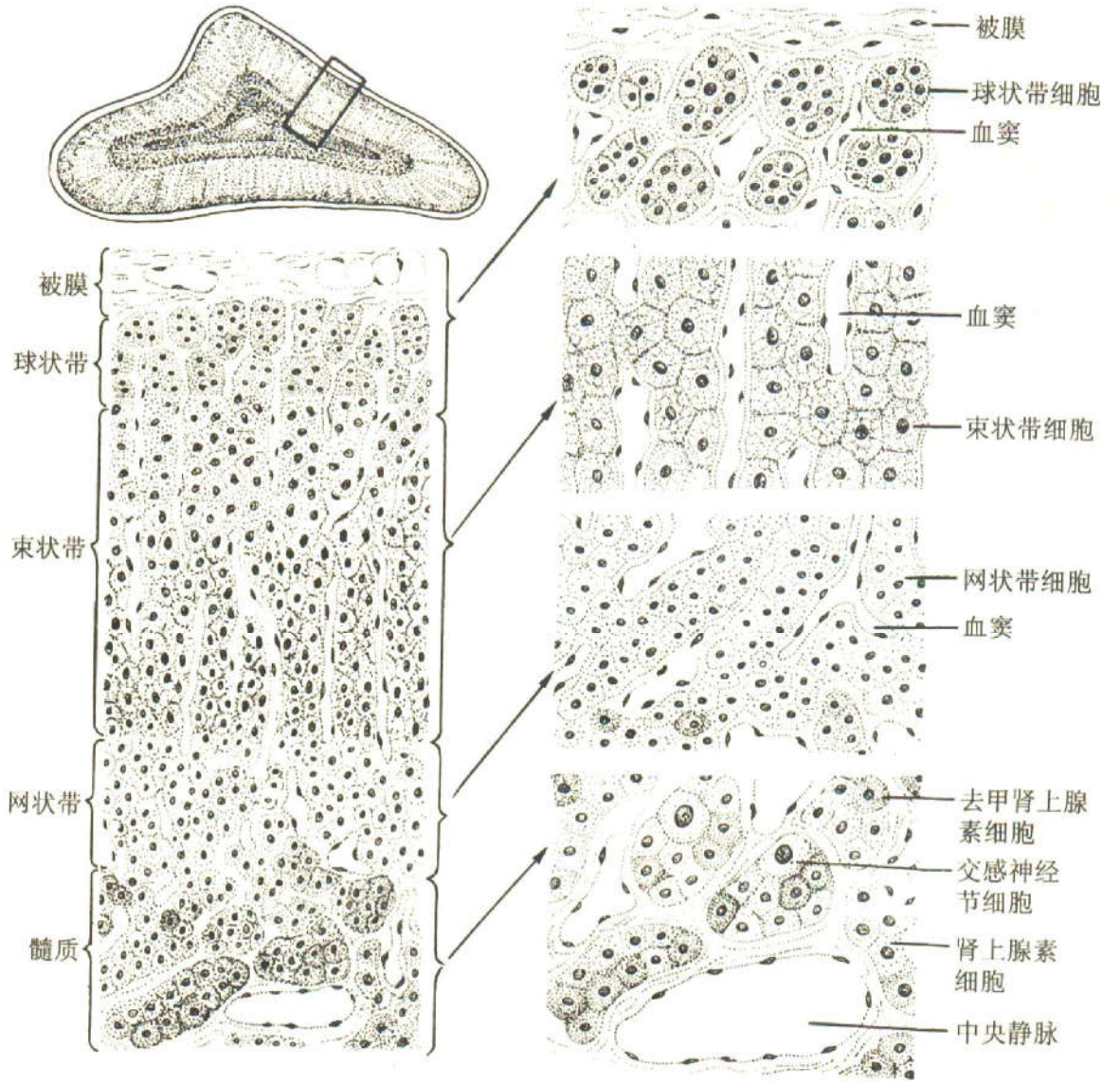


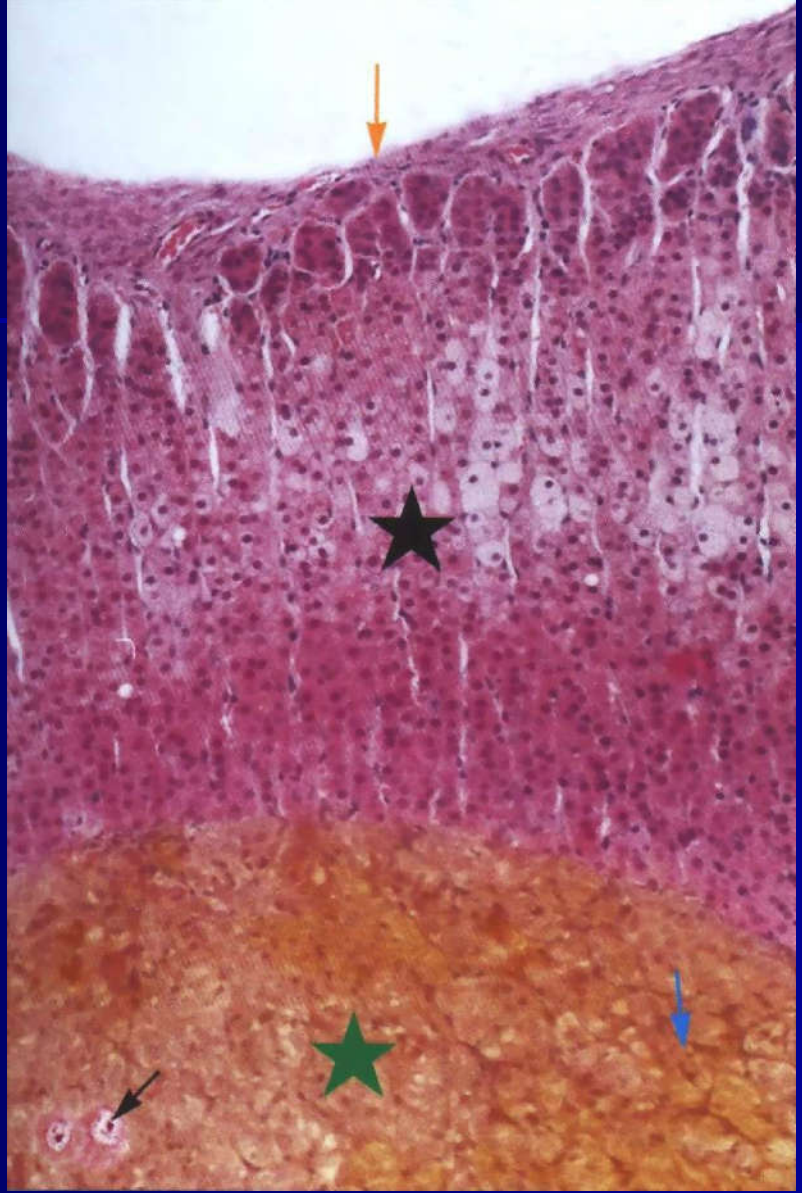
IV. Adrenal gland

capsule

cortex

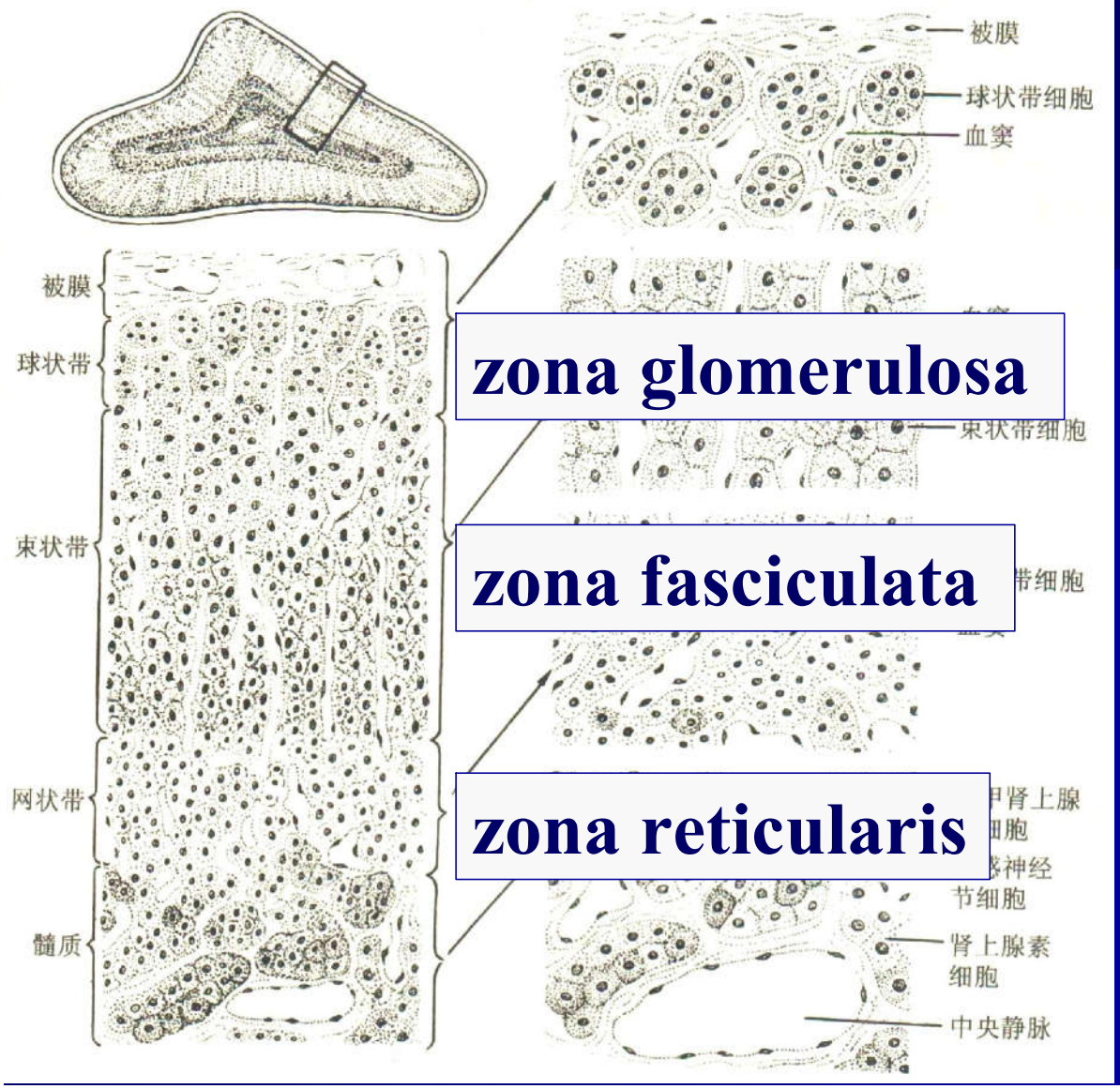
medulla





- **Cortex　　80～90%**

Three layers
- **zona glomerulosa**
- **zona fasciculata**
- **zona reticularis**


被膜
球状带
束状带
网状带
髓质
被膜
球状带细胞
血窦
束状带细胞
肾上腺
细胞
节细胞
肾上腺素
细胞
中央静脉
zona glomerulosa
zona fasciculata
zona reticularis

- **zona glomerulosa**

  *beneath the capsule

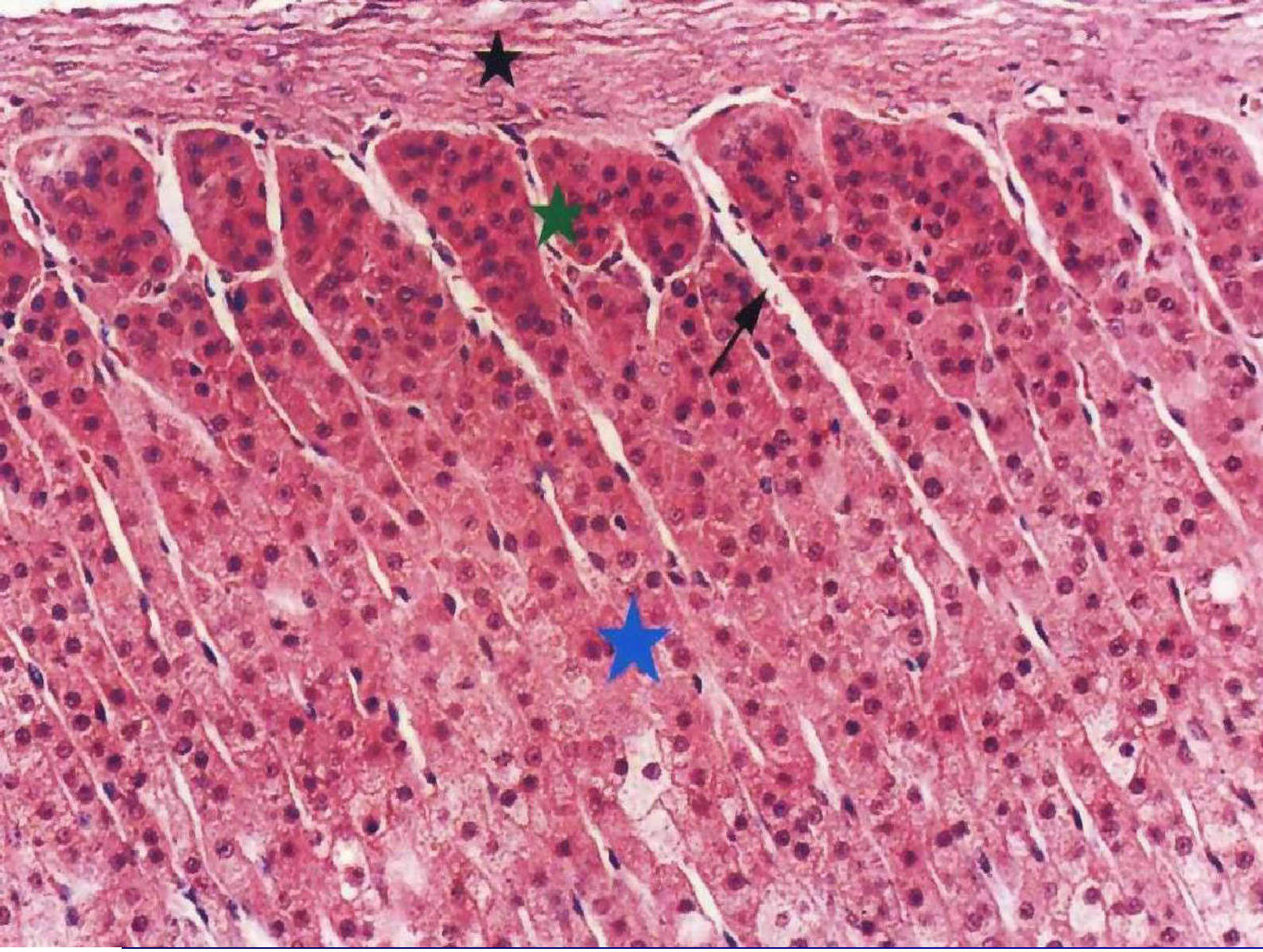
  *small cells in rounded or clusters

  *sinusoidal capillaries

  *mineralocorticoid 盐皮质激素

  （aldosterone 醛固酮）

  maintain electrolyte (Na^+, K^+) and water balance (absorption of Na^+ & excrete K^+)



- **zona fasciculata**

***thick most layer *straight cords**

***sinusoidal capillaries**

***polygonal cells with lipid droplets (vacuolated)**

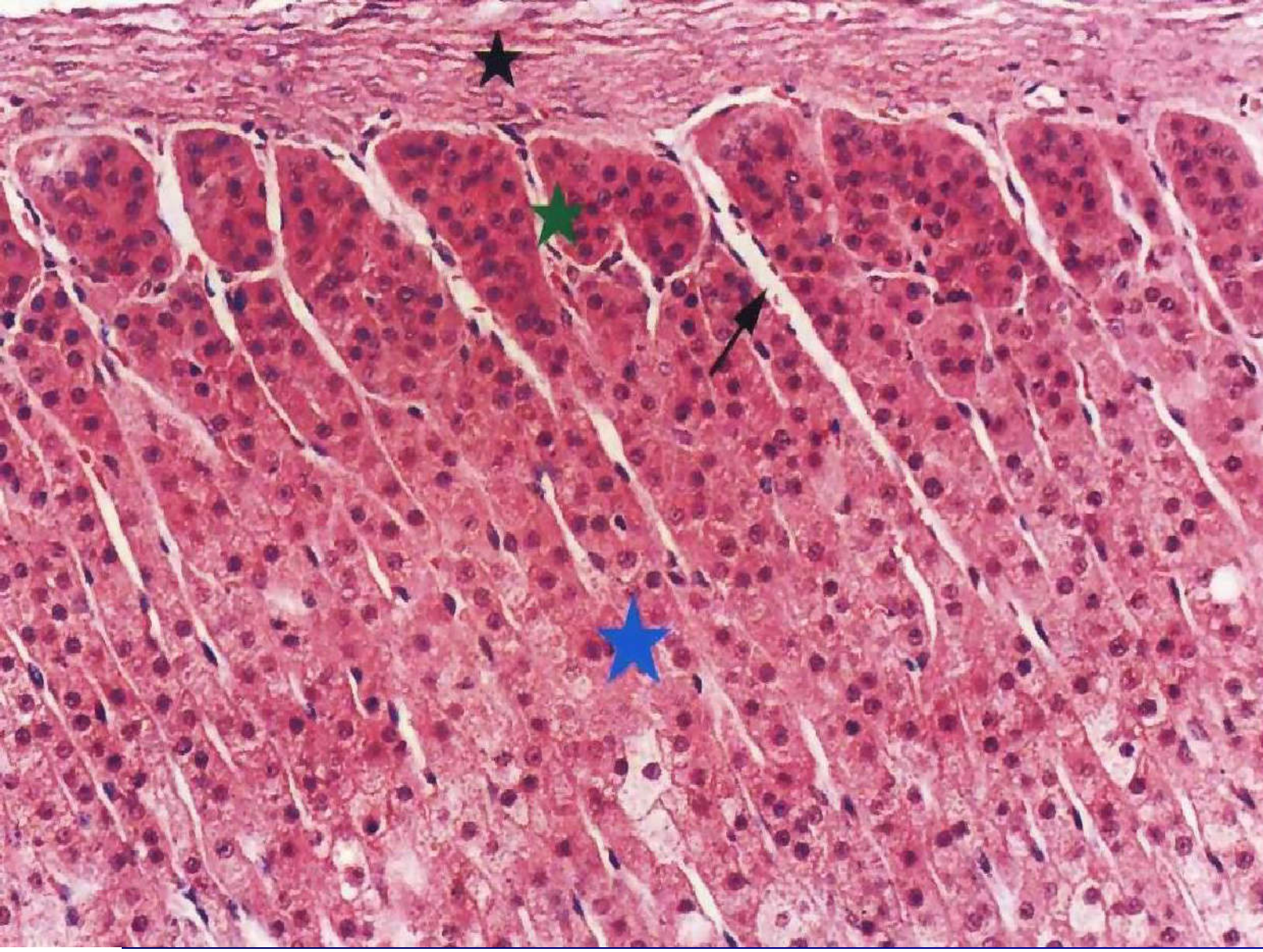
***glucocorticoid (ACTH) 糖皮质激素 (cortisol)**

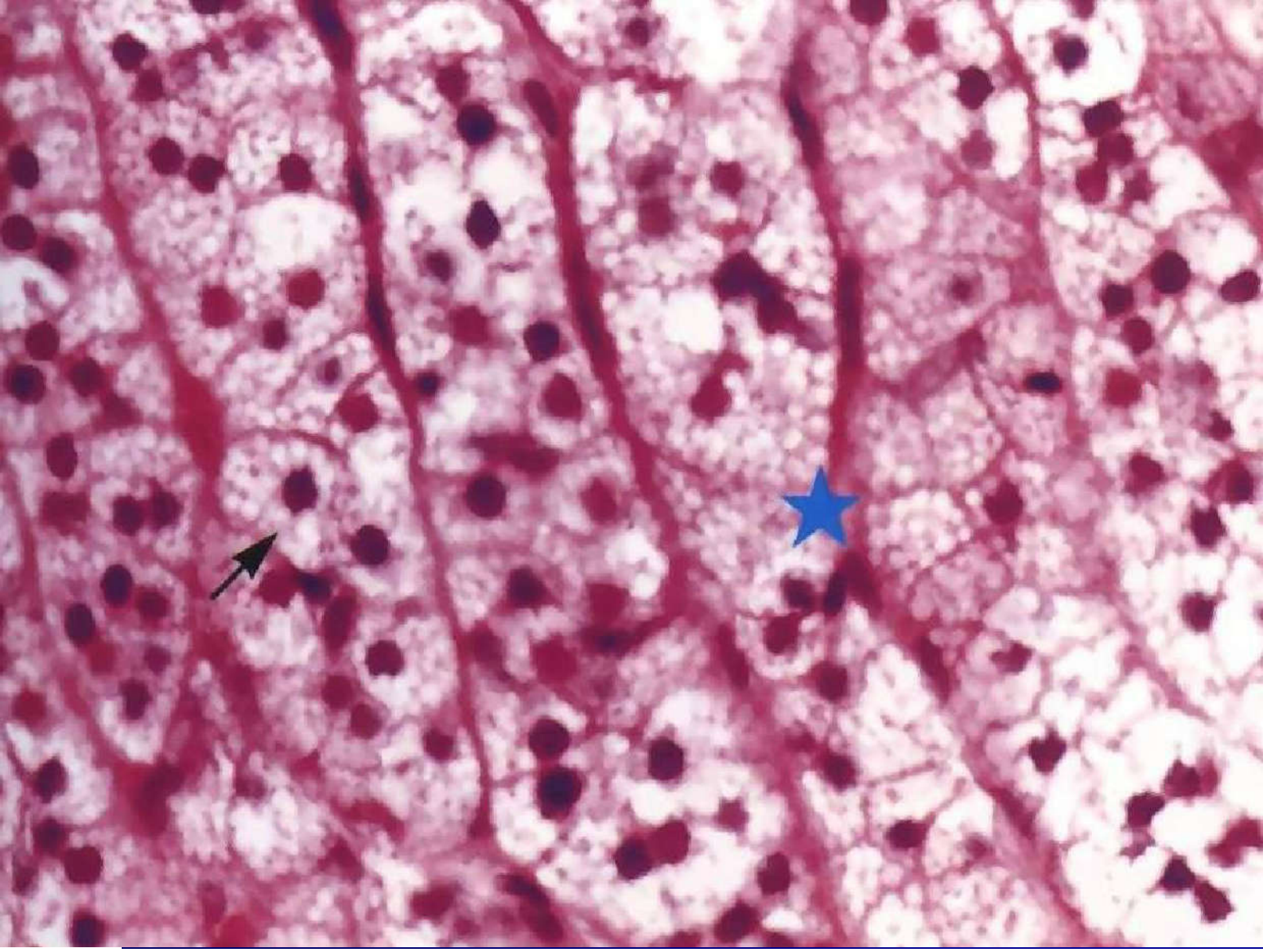
stimulate the metabolism of

carbohydrates, proteins and lipids

suppress the inflammatory &

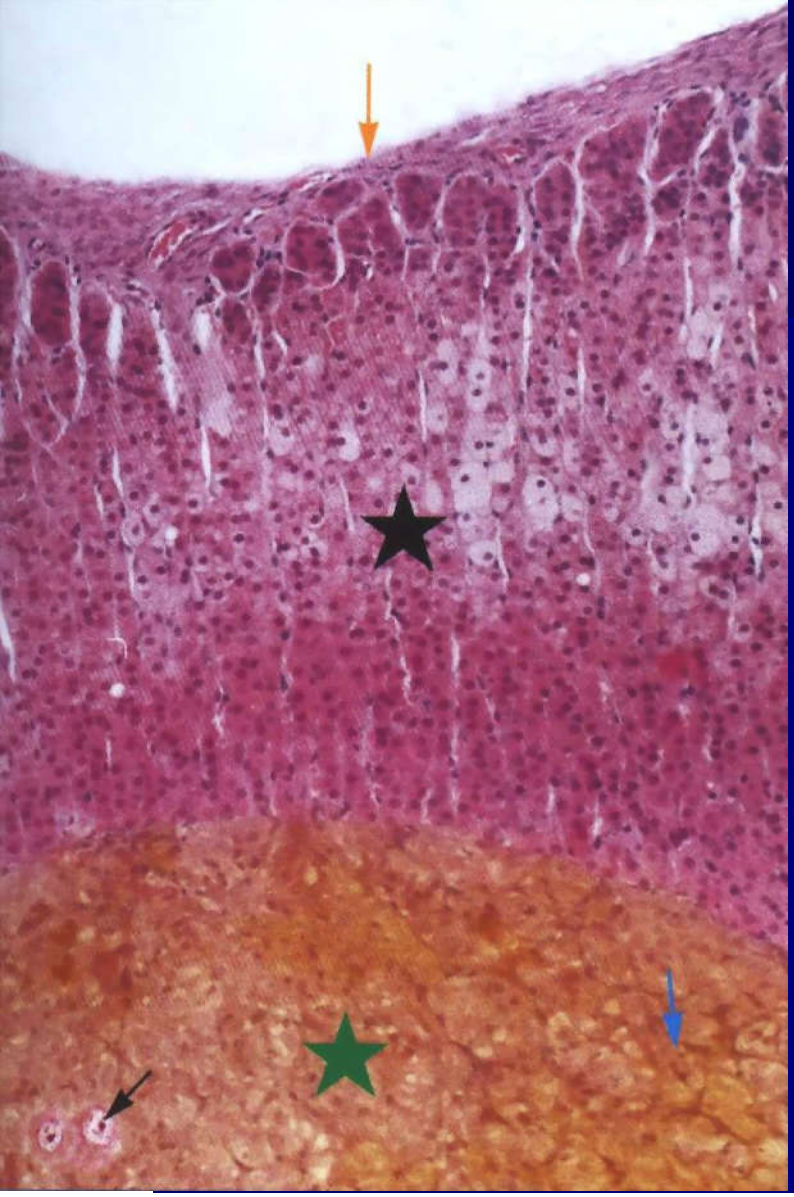
immune response





- zona reticularis
  - * innermost layer
  - * irregular cords form an anastomosing network
  - * smaller cells with lipofuscin pigment granules & lipid droplet

    —— androgen 雄激素



*all cells in cortex are steroid secreting cells

SER

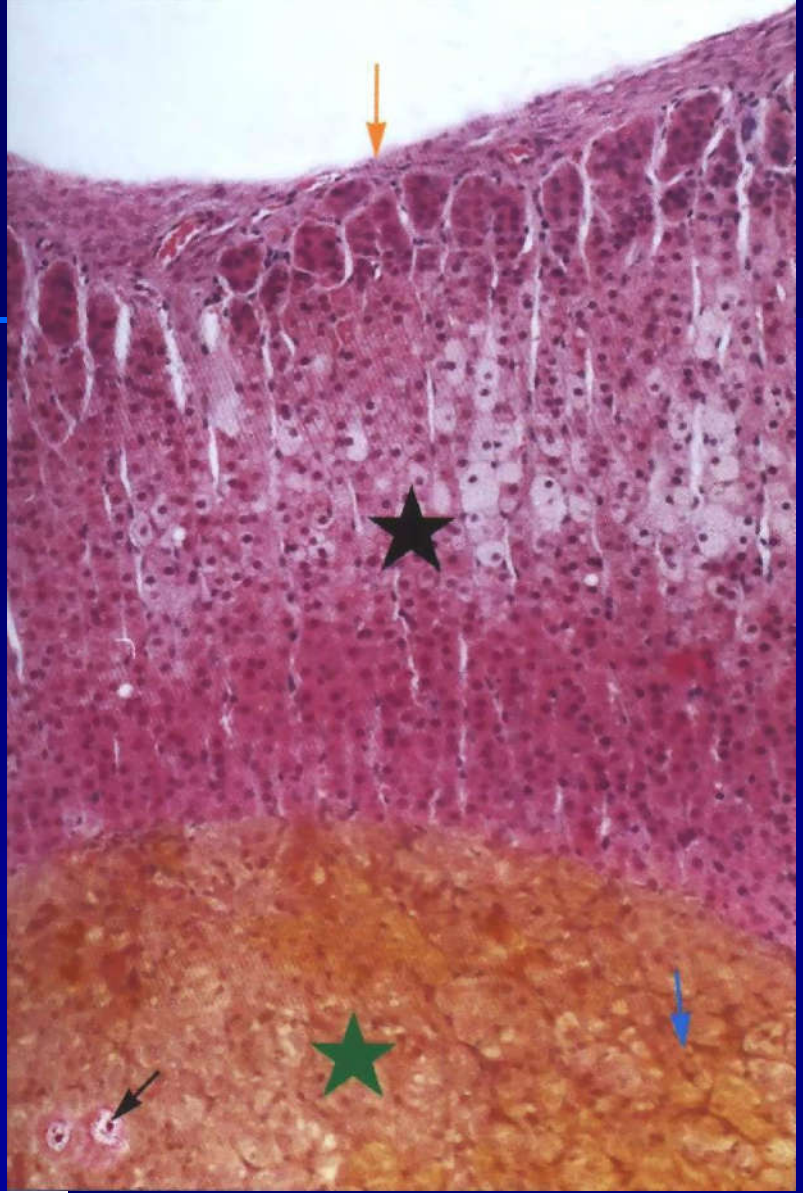
Mitochondria with tubular cristae

lipid droplets

- **Medulla**

  * **cells in cords or clumps**
  * **sinusoidal cap**
  * **chromaffin cell** 嗜铬细胞

    (chromaffin granules)



chromaffin cell

- two types:

*adrenic cells — adrenaline

heart rate ↑

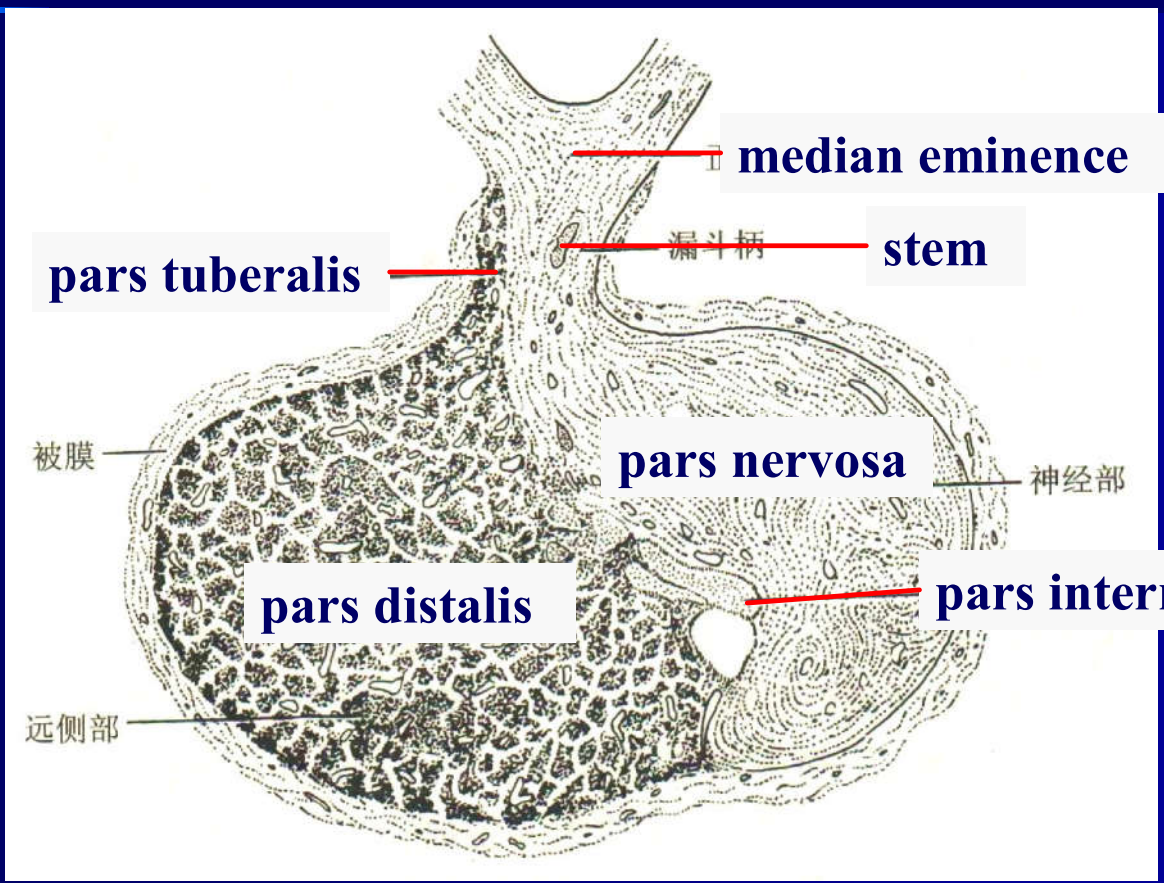
blood vessels dilatation ↑

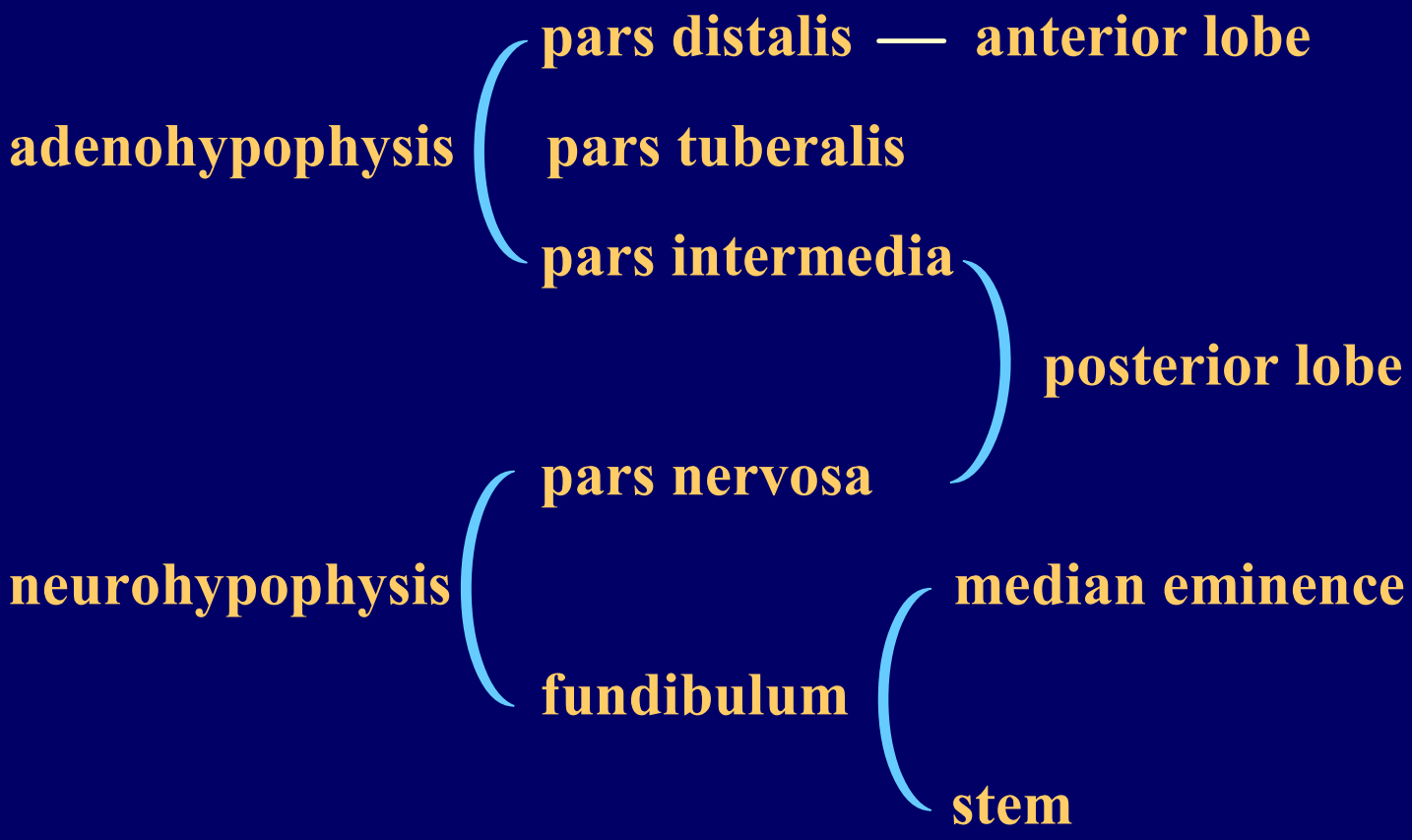
*noradrenic cells — noradrenaline

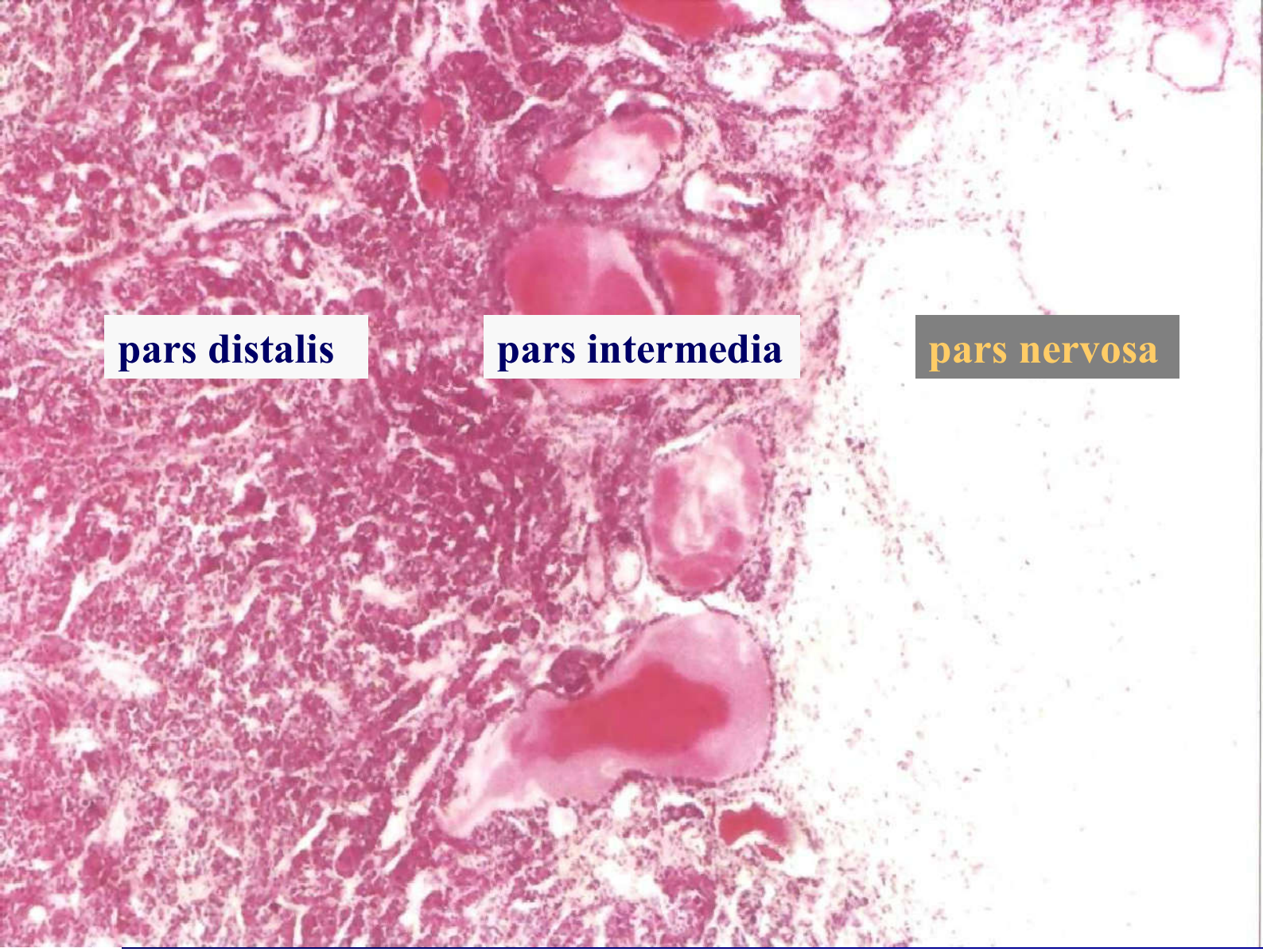
blood pressure ↑

V. Hypophysis (Pituitary gland)

in a cavity of the sphenoid bone (sella turcica)




pars distalis — anterior lobe
adenohypophysis
pars tuberalis
pars intermedia
posterior lobe
pars nervosa
neurohypophysis
median eminence
fundibulum
stem


pars distalis
pars intermedia
pars nervosa

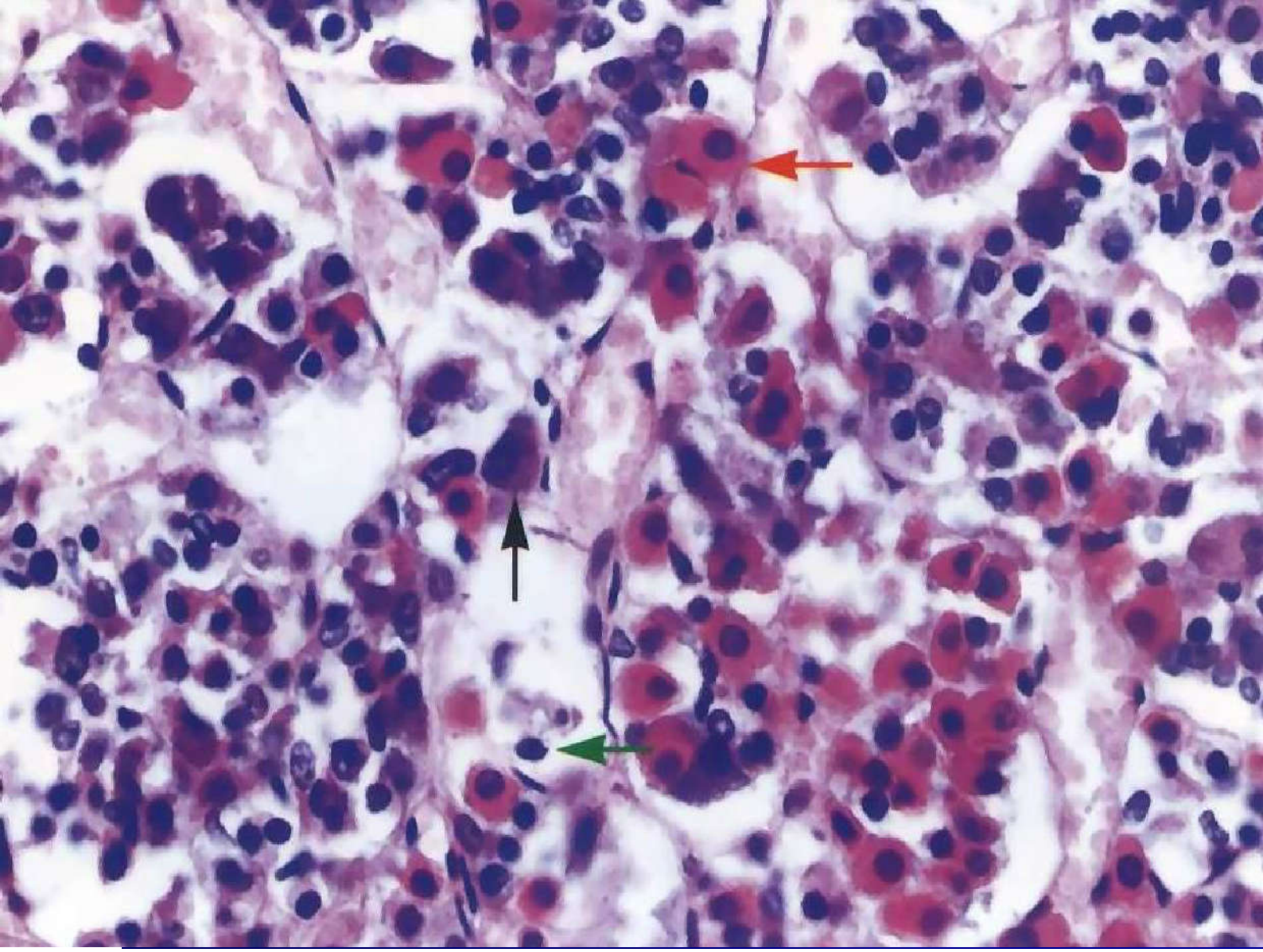
- Adenohypophysis

- pars distalis

  glandular cells in clusters and cords

  rich in blood sinuses

HE:
- chromophobes
- chromophils
  - acidophils
  - basophils



① **acidophils**

contain acidophilic granules (two types)

// somatotropic cell 生长激素细胞

***growth hormone*, GH**

stimulate the growth of long bone

disorder:

***young children**

hypofunction —— midget 侏儒症

hyperfunction ——gigantism 巨人症

***adult —— megalakria 肢端肥大症**

18 years old

// **mammotropic cell** 催乳激素细胞

mammotropin 催乳激素

stimulate *development of breast

***milk secretion**

② basophils

contain basophilic granules (three types)

// thyrotropic cell,

TSH cell 促甲状腺激素细胞

thyrotropin (thyroid stimulating hormone TSH)

stimulate thyroid hormone synthesis, storage & release

// gonadotropic cell 促性腺激素细胞

*follicle stimulating hormone, FSH

卵泡刺激素

female: promote development of follicles

male: stimulate Sertoli cells to synthesize androgen binding protein, ABP

*luteinizing hormone, LH 黄体生成素

female: stimulate ovulation &

formation of corpus luteum

male: stimulate interstitial cell to secret

androgen

// corticotropic cell,

ACTH cell 促肾上腺皮质激素细胞

adrenocorticotropin,

ACTH 促肾上腺皮质激素

promote zona fasciculatis to

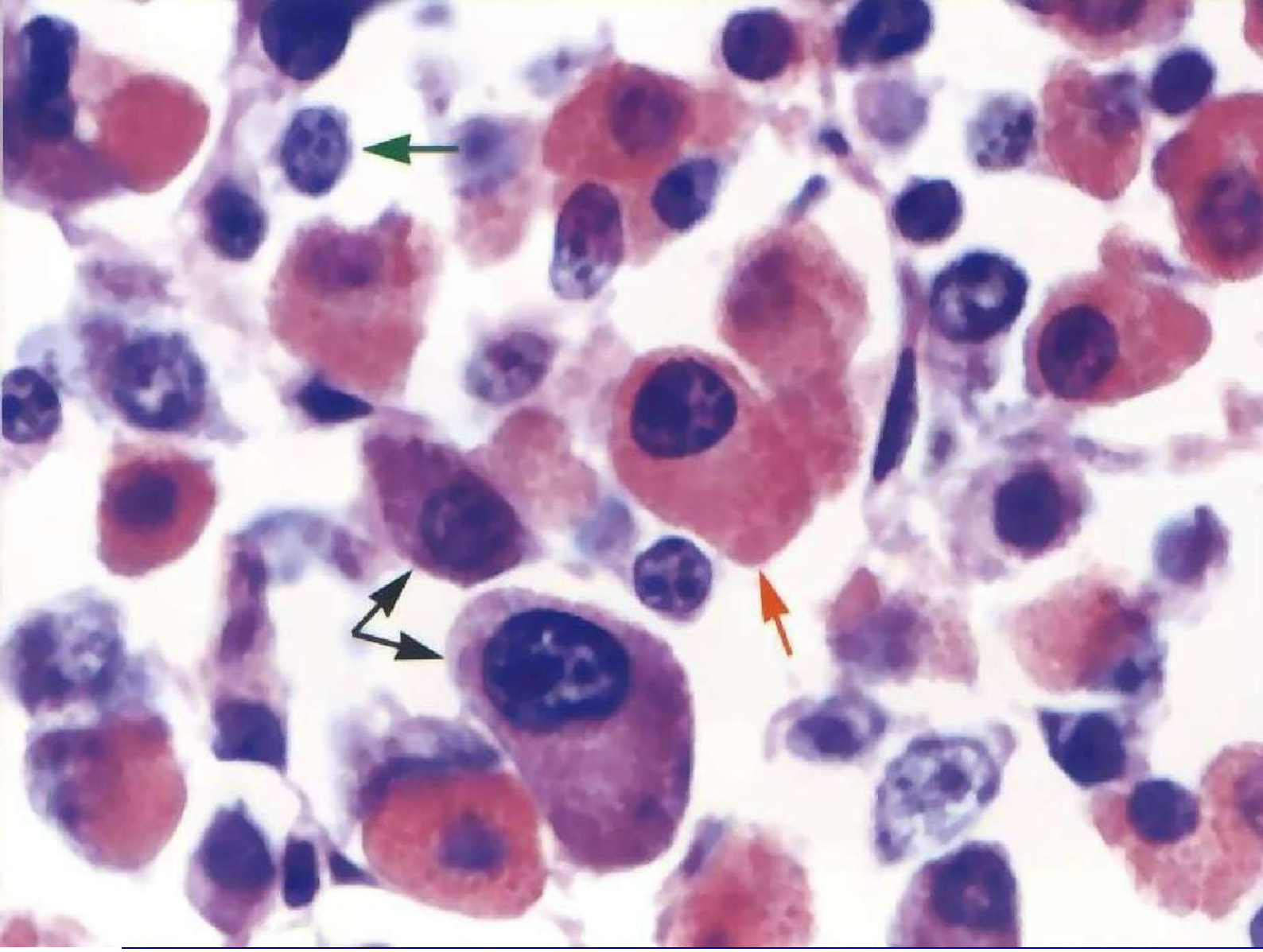
secret glucocorticoid

③ Chromophobe cell 嫌色细胞 (50%)

smaller

pale staining

will form chromophils



*chromophobes

*chromophils
- acidophils
  - GH
  - mammotropin
- basophils
  - TSH
  - FSH & LH
  - ACTH

- **Pars intermedia**

  degenerative part in human

  - **chromophobes**
  - **basophils**
  - **follicles**

  melanocyte stimulating hormone, MSH in fish and amphibian

- **Pars tuberalis ——rich in capillaries**

hypophyseal portal system 垂体门脉系统

superior hypophyseal artery

↓

primary cap plexus (fundibulum)

↓

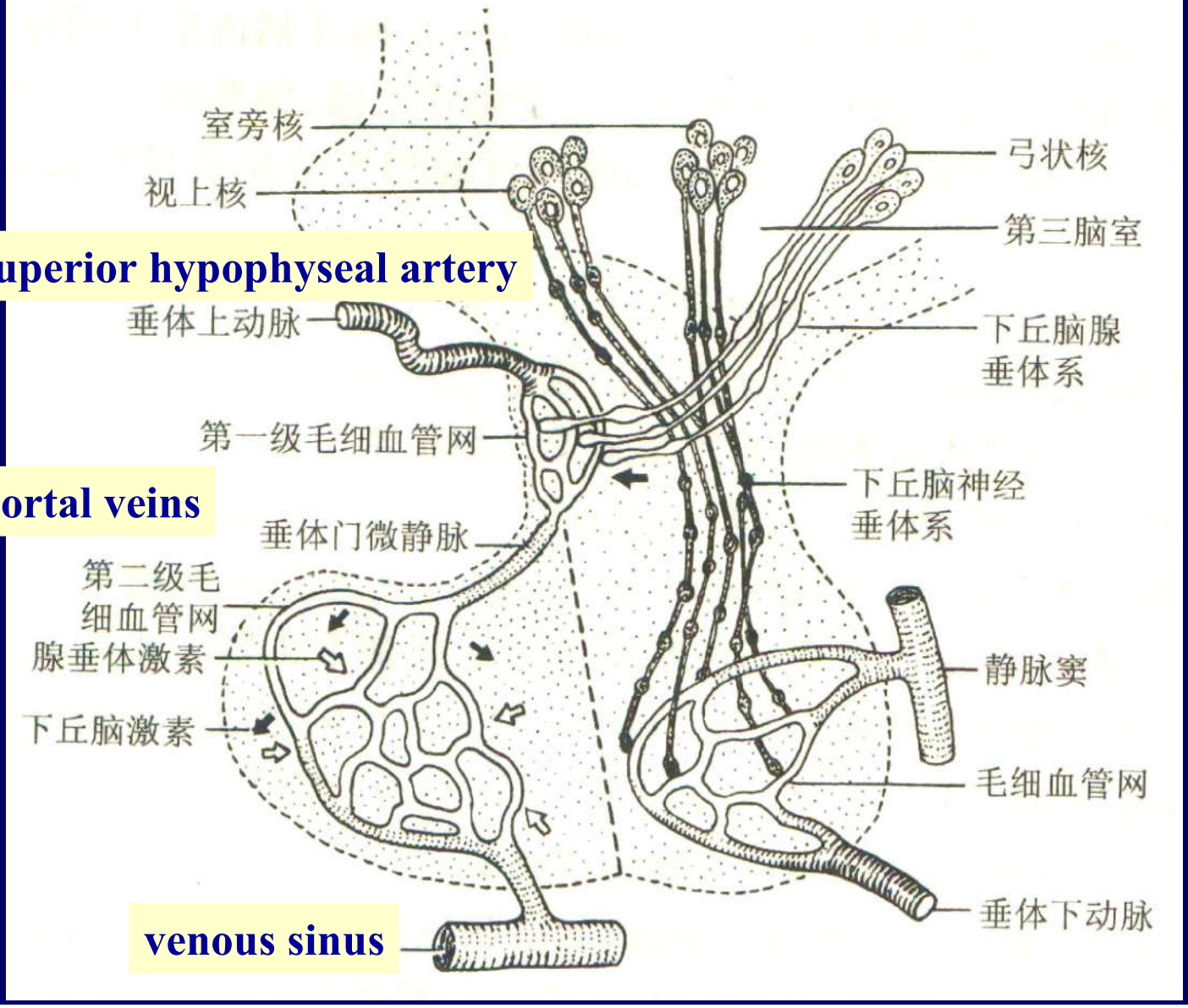
hypophyseal portal veins (pars tuberalis)

↓

secondary cap plexus (pars distalis)

↓

venous sinus



superior hypophyseal artery

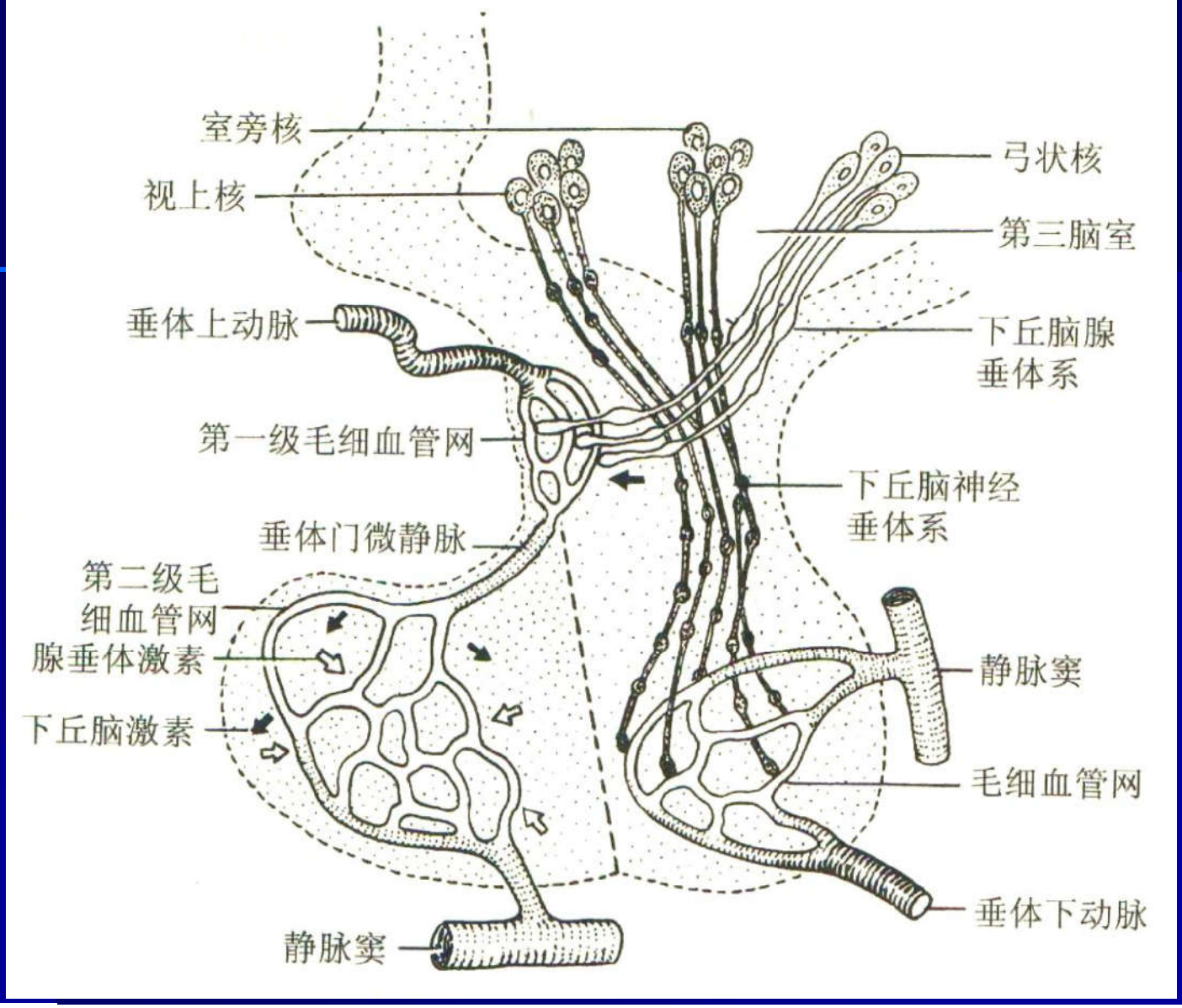
portal veins

venous sinus

- **relationship of hypothalamus – adenohypophysis**

hypothalamus (neurosecretory cells)

- **releasing hormones**
- **release inhibiting hormones**


室旁核
视上核
垂体上动脉
第一级毛细血管网
垂体门微静脉
第二级毛
细血管网
腺垂体激素
下丘脑激素
静脉窦
弓状核
第三脑室
下丘脑腺
垂体系
下丘脑神经
垂体系
静脉窦
毛细血管网
垂体下动脉

hypothalamo-hypophyseal system

GRH 生长激素释放激素

PRH 催乳激素释放激素

TRH 促甲状腺激素释放激素

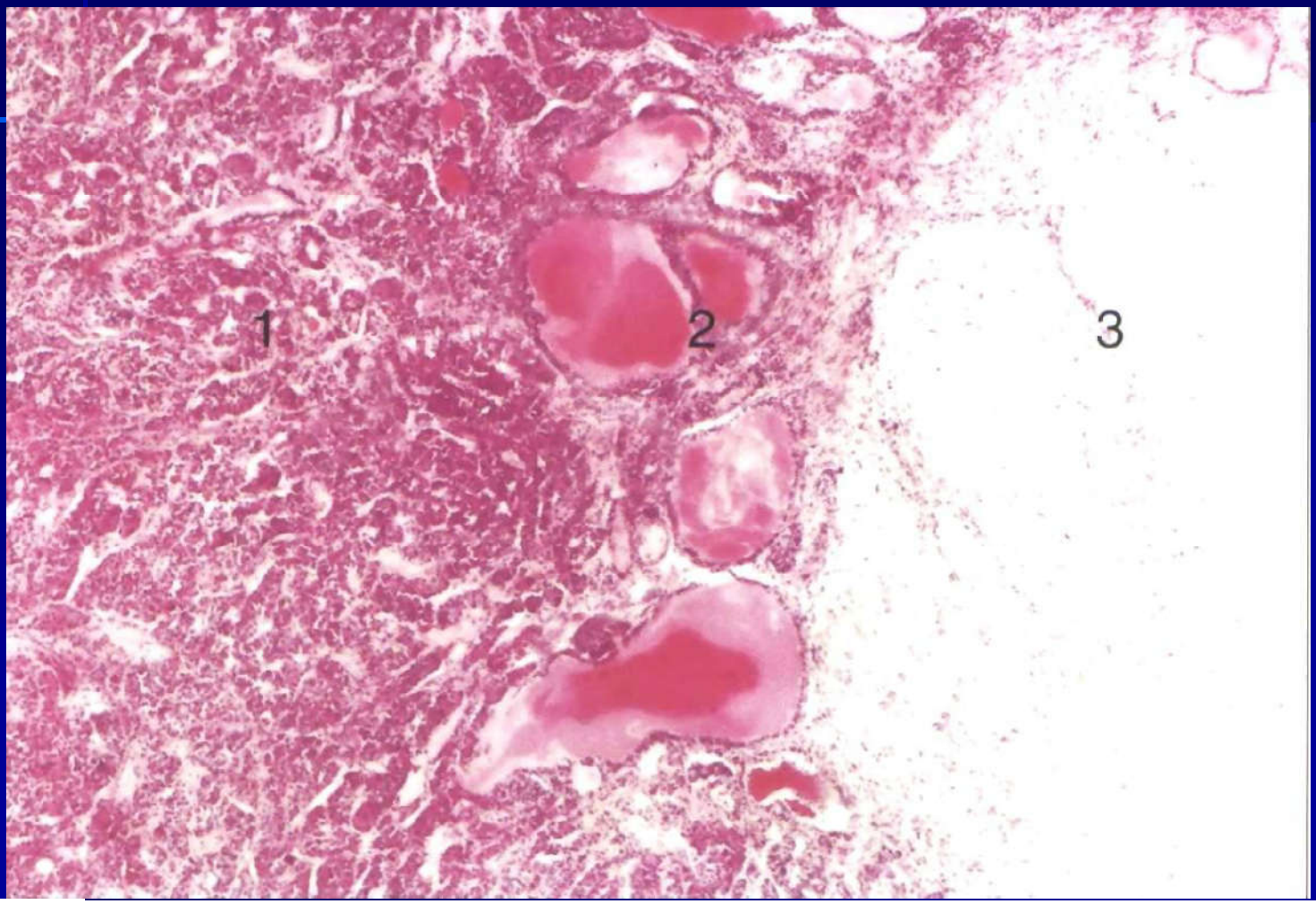
GnRH 促性腺激素释放激素

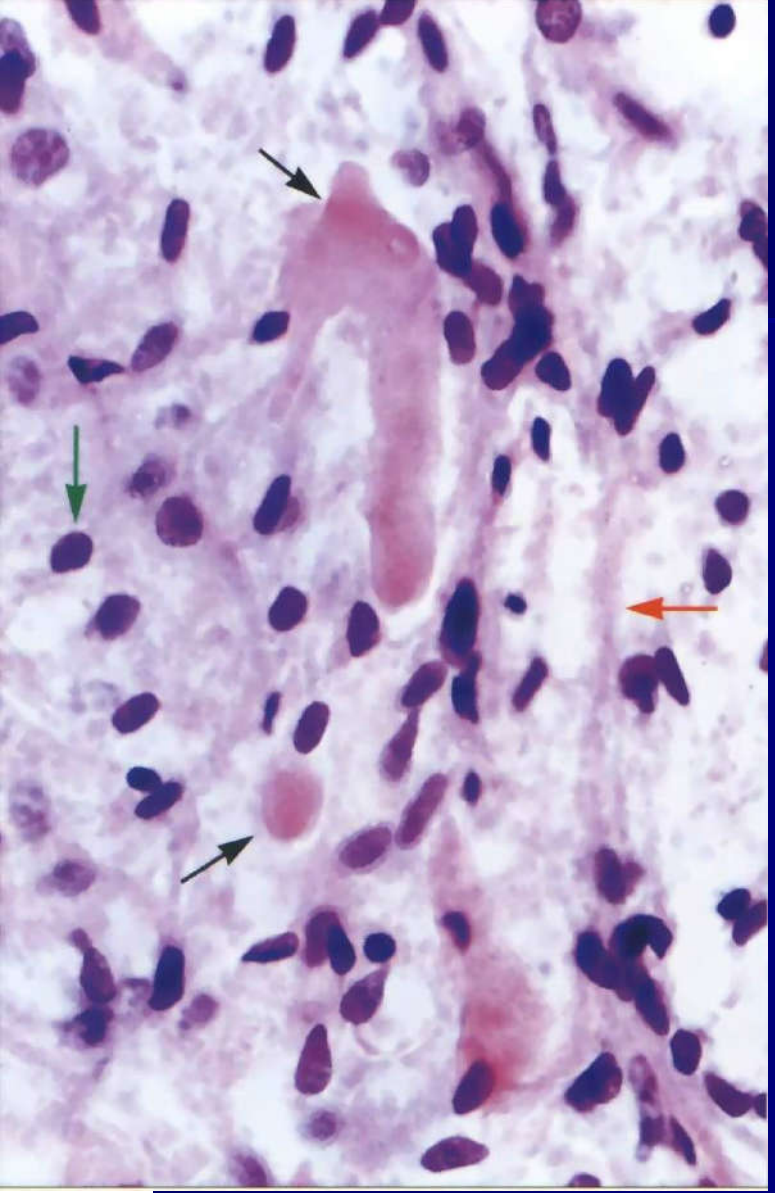
CRH 促肾上腺皮质激素释放激素

SOM 生长抑素

PIH 催乳激素释放抑制激素

- **Neurohypophysis**





*unmyelinated nerve f.

*neuroglial cells
(pituicytes)

*numerous sinuses

*Herring bodies

- **relationship of hypothalamus – neurohypophysis**

hypothalamus (PVN, SON)

|

oxytocin & vasopressin (ADH)

|

neurohypophysis

|

release into blood

ADH:

promote distal & collecting tubules

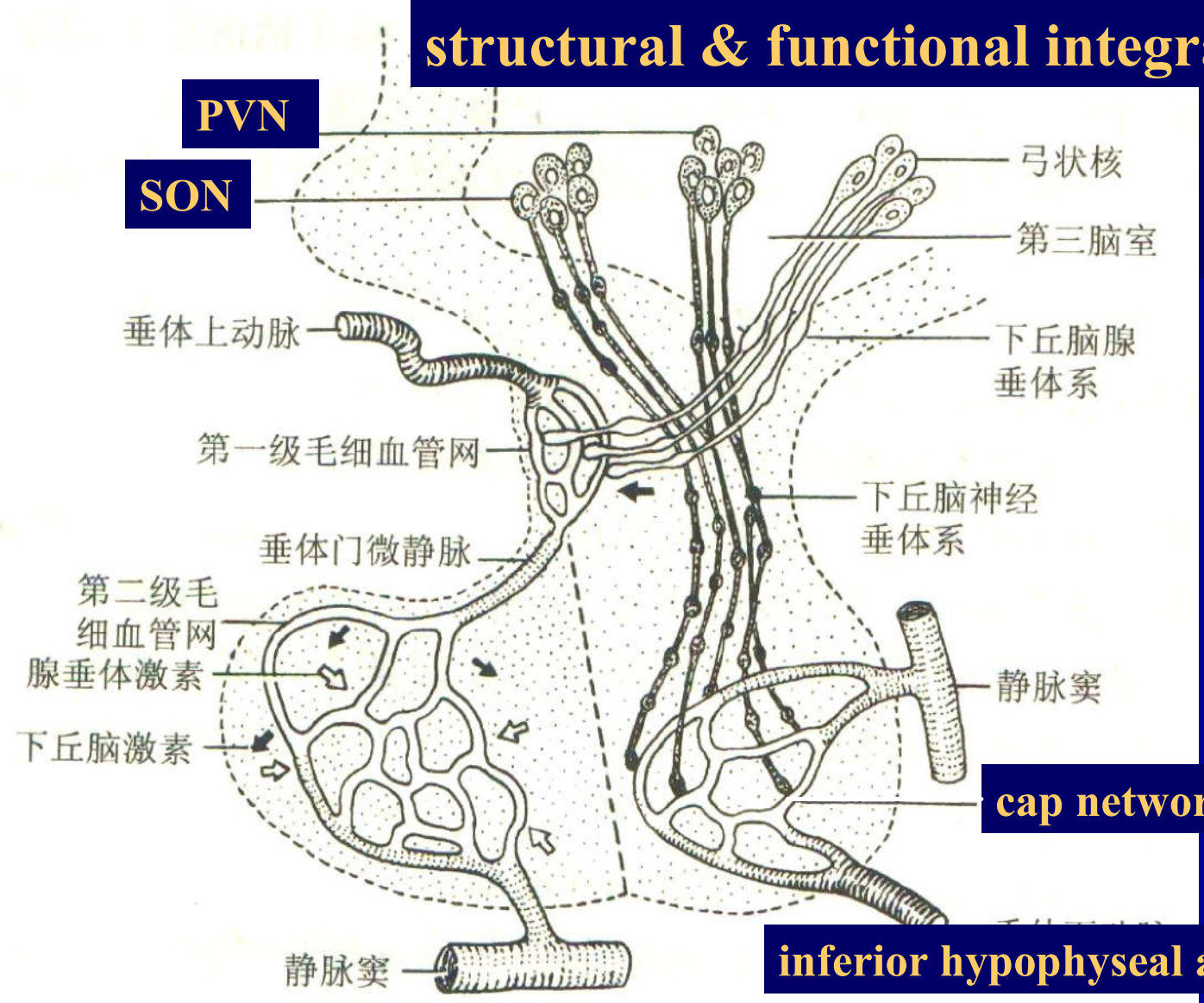
to absorb water ⟶ volume of urine ↓

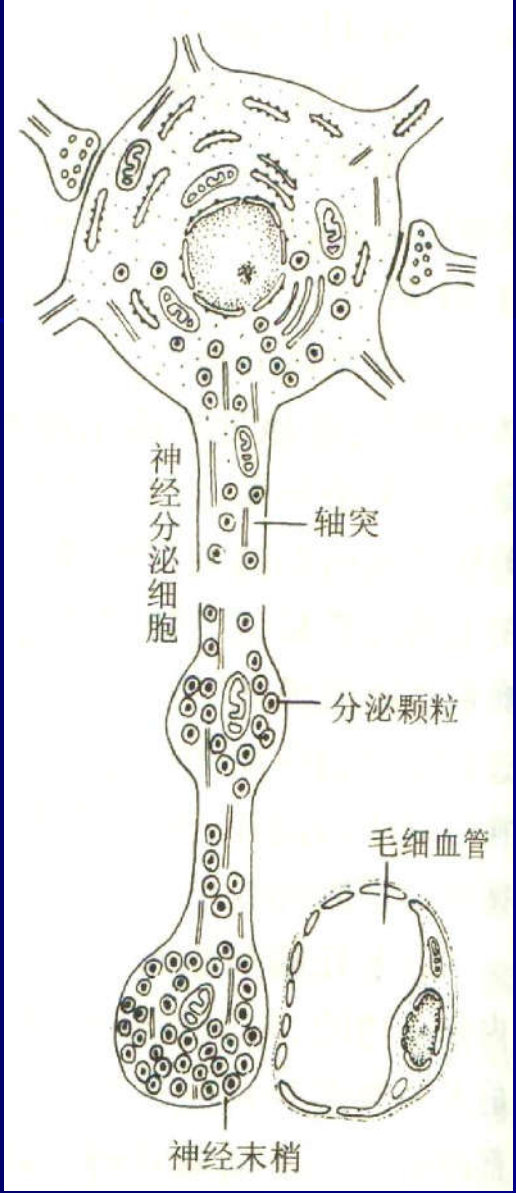
oxytocin:

*stimulates contraction of the smooth muscles of uterine wall

*promotes secretion of breast

structural & functional integration





Herring bodies