

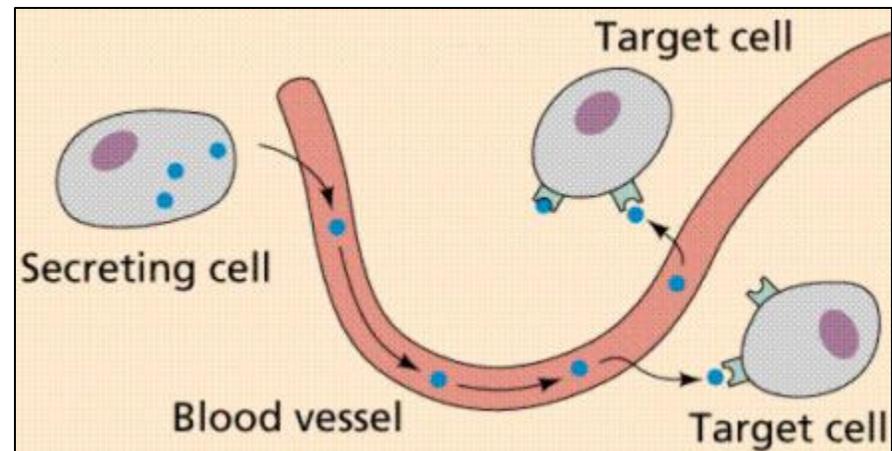
Sistema Endócrino

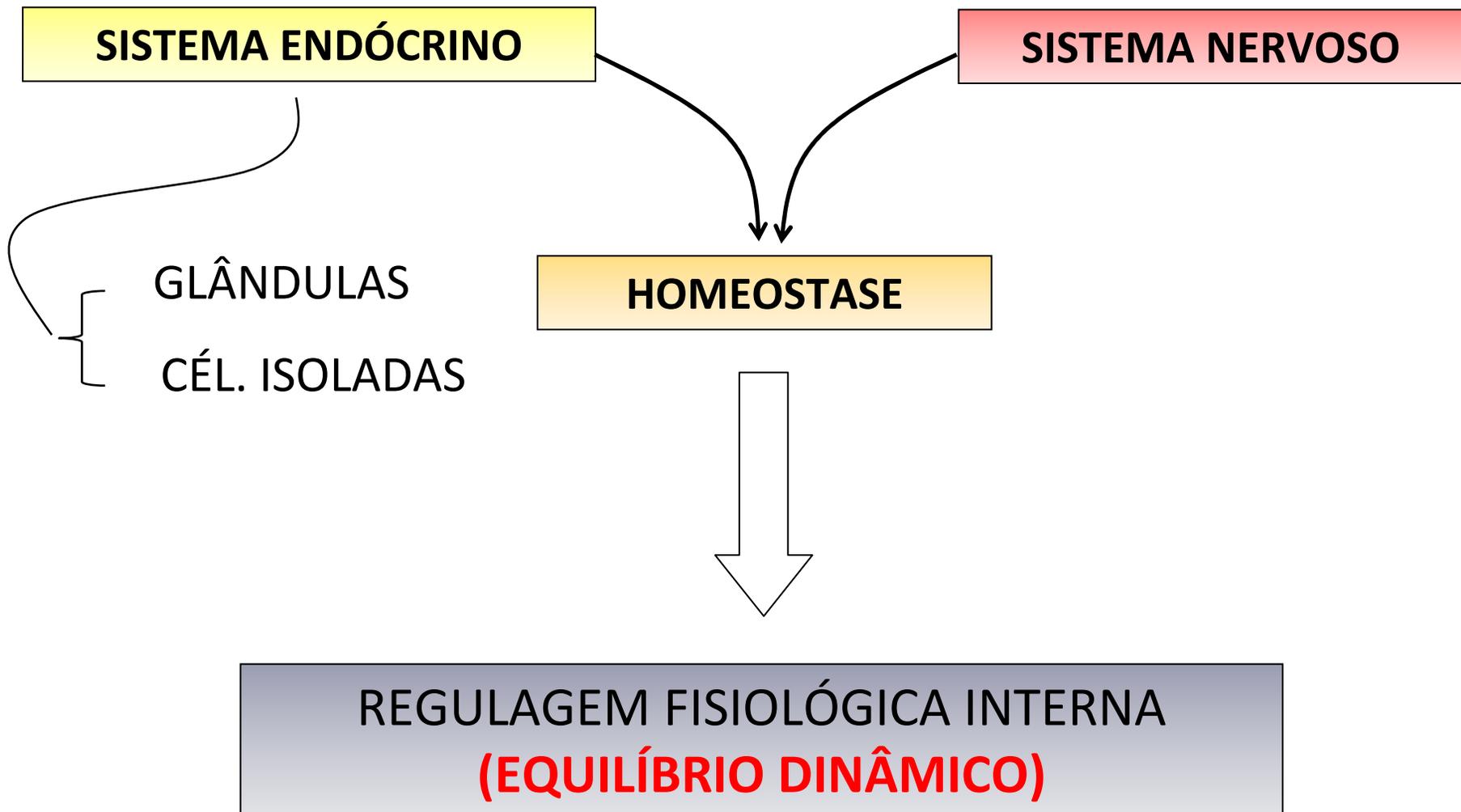
Sistema Endócrino

- Células isoladas: Células APUD
- Partes de glândula mista (ilhotas pancreáticas)
- Glândulas propriamente ditas

Glândulas Endócrinas

- sem ductos
- secreção endócrina/parácrina/autócrina
- órgão(s) alvo (s): receptor específico
- hormônios
 - esteróides
 - polipeptídicos
 - protéicos
 - glicoprotéicos





MECANISMO DE CONTROLE HORMONAL

CONTROLE AUTÓCRINO: hormônios agem nas próprias células ou em células do mesmo tipo - IGF

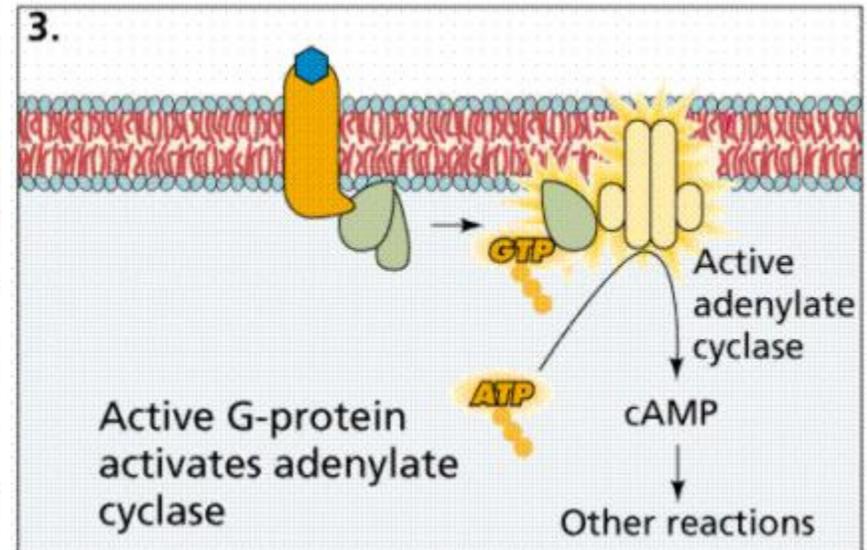
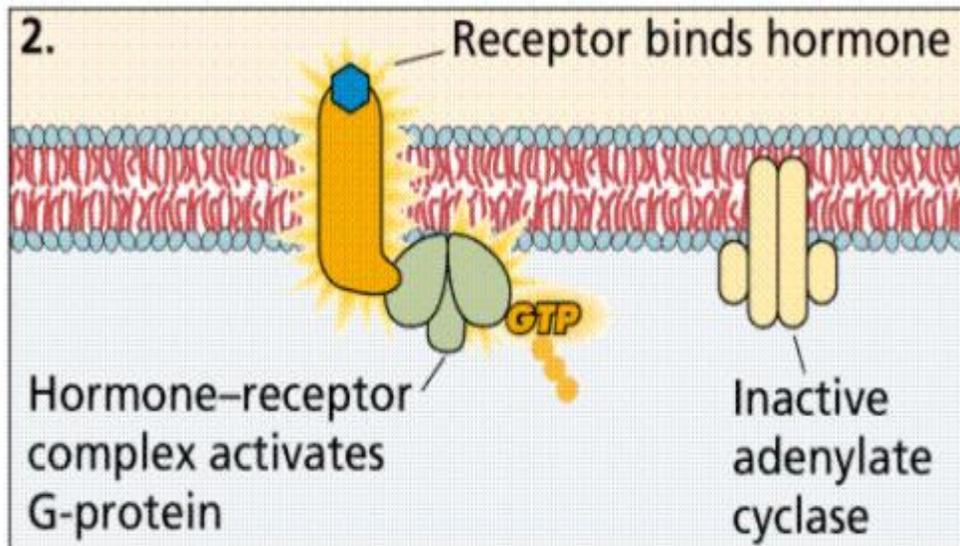
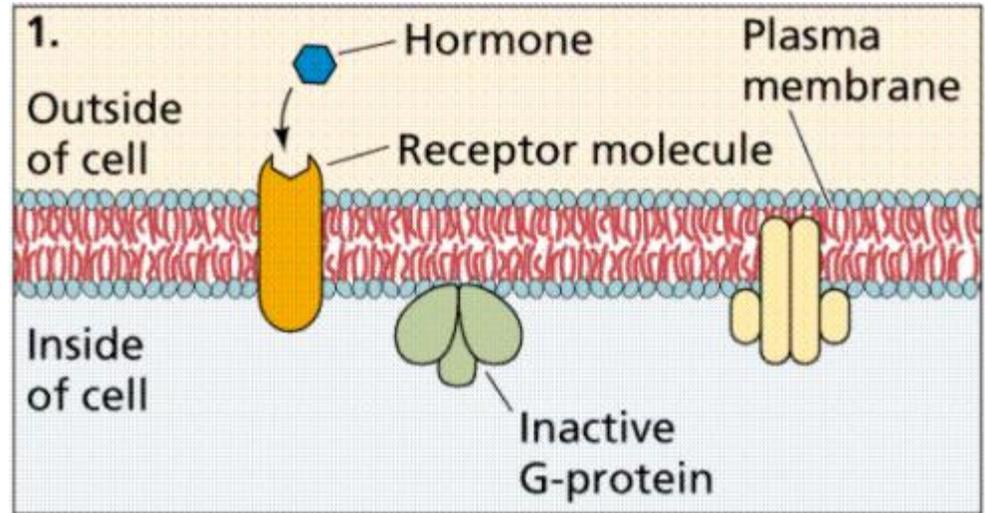
CONTROLE PARÁCRINO: hormônio é conduzido por curto trajeto até a célula-alvo – gastrina, somatostatina

CONTROLE ENDÓCRINO: hormônio é liberado na matriz extracelular – sangue - células-alvo (maioria dos hormônios)

Sistema Endócrino

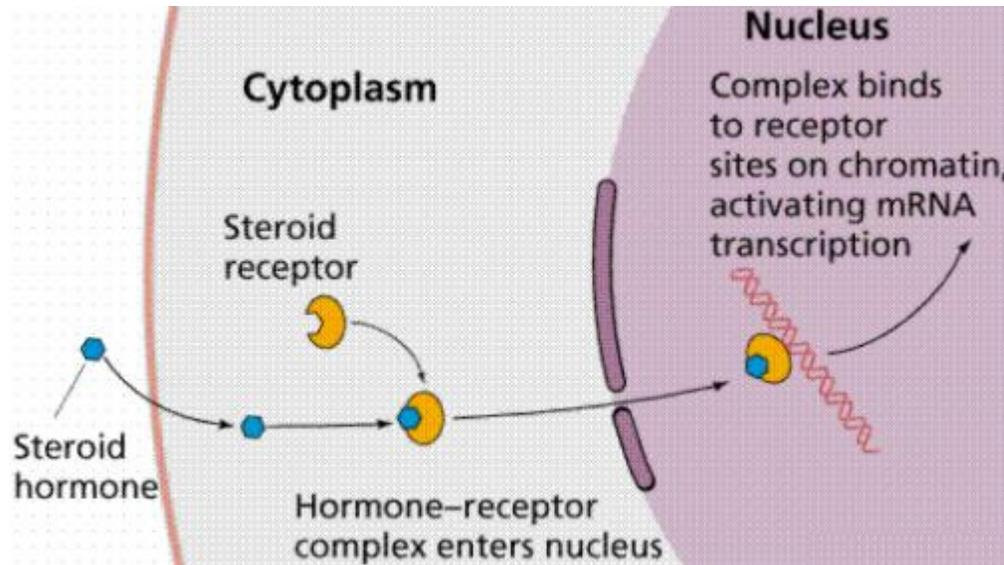
Hormônio- Receptor celular: mecanismo de ação

Hormônios não esteróides

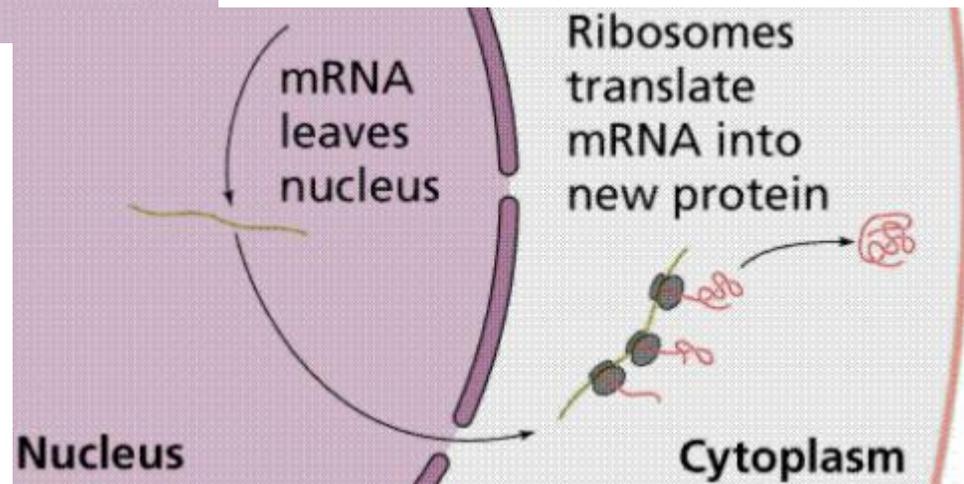


Sistema Endócrino

Hormônio- Receptor celular: mecanismo de ação

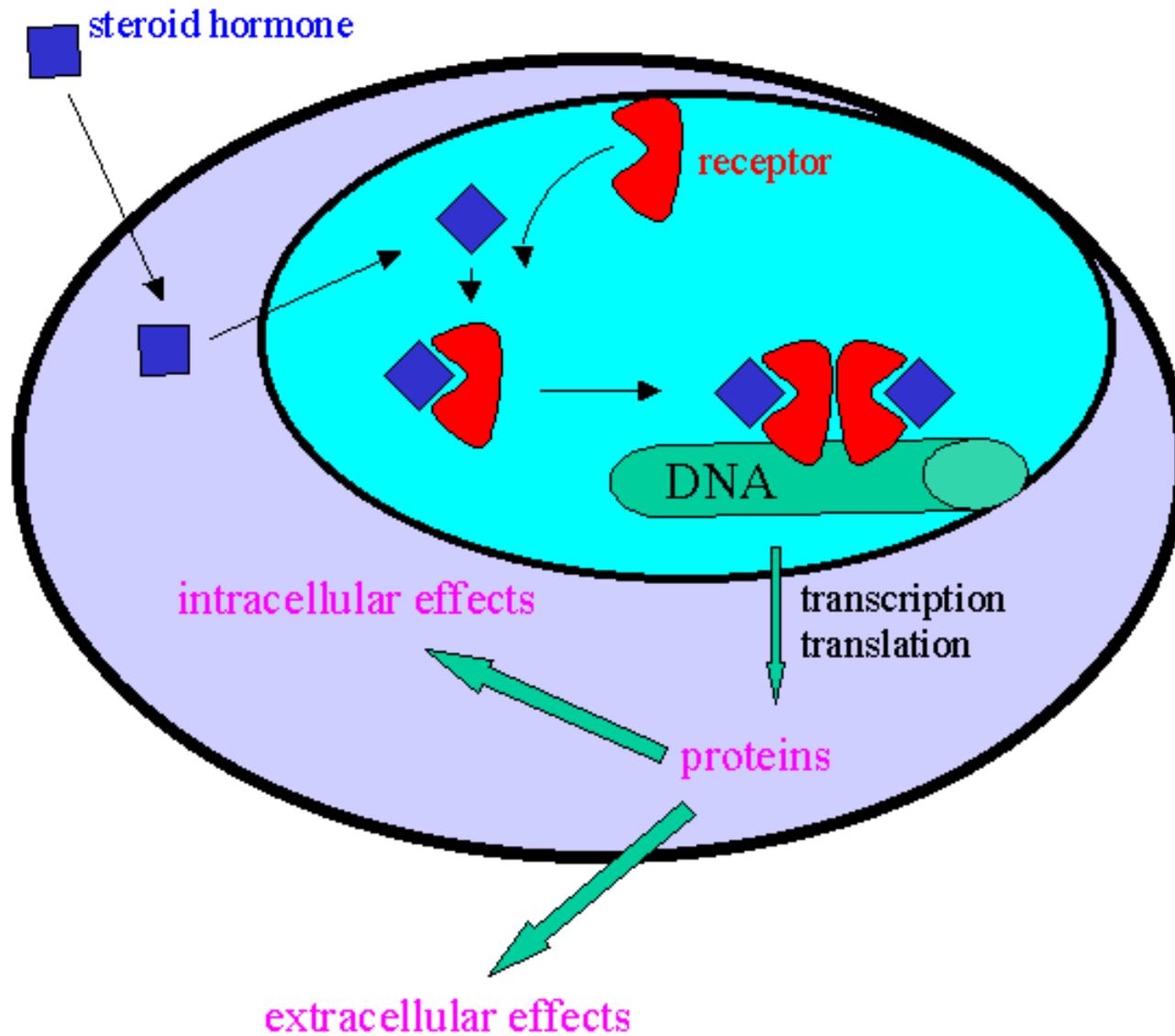


Hormônios esteróides



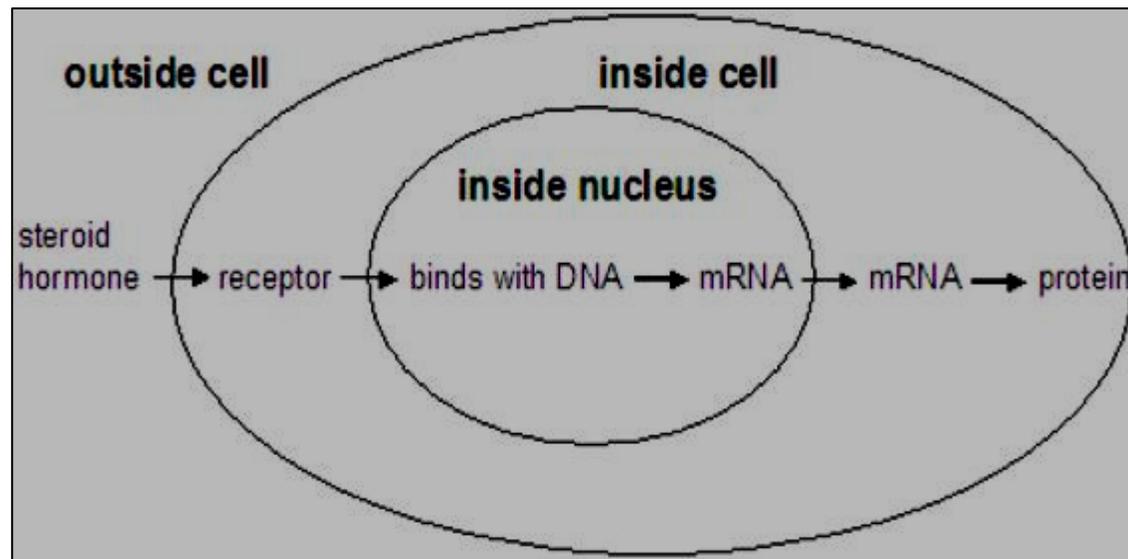
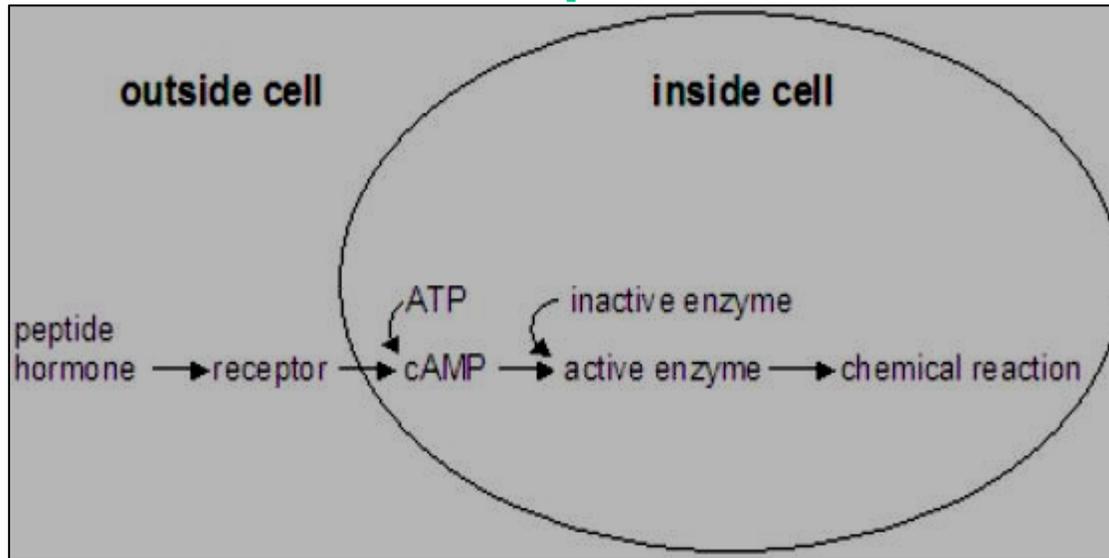
Sistema Endócrino

Hormônio- Receptor celular: mecanismo de ação



Sistema Endócrino

Hormônio- Receptor celular: mecanismo de ação



Sistema Endócrino

➤ Glândulas endócrinas clássicas

Número de células

- multicelulares

pineal, paratireóide, tireóide, adrenal, hipófise

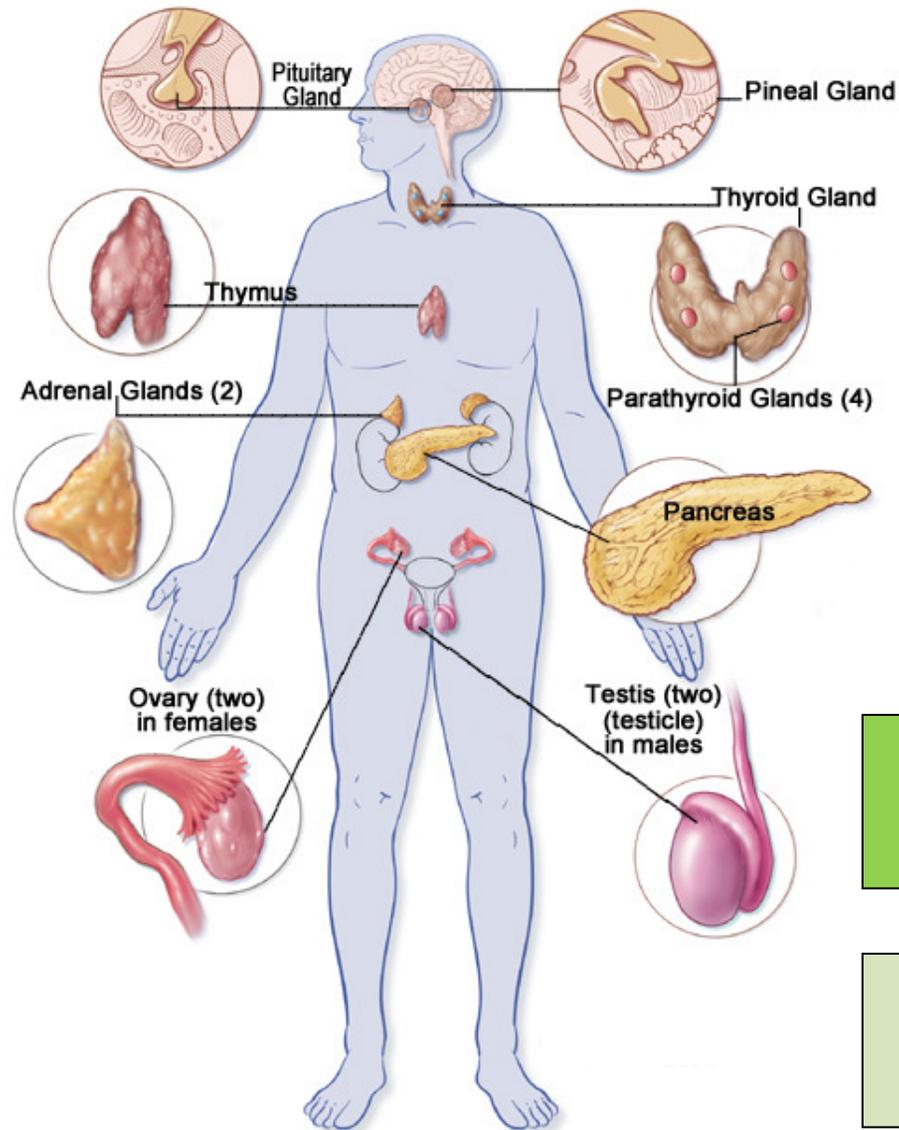
- unicelulares

sistema neuroendócrino difuso

Morfologia

- vesicular ou folicular
- cordonal

GLÂNDULAS ENDÓCRINAS



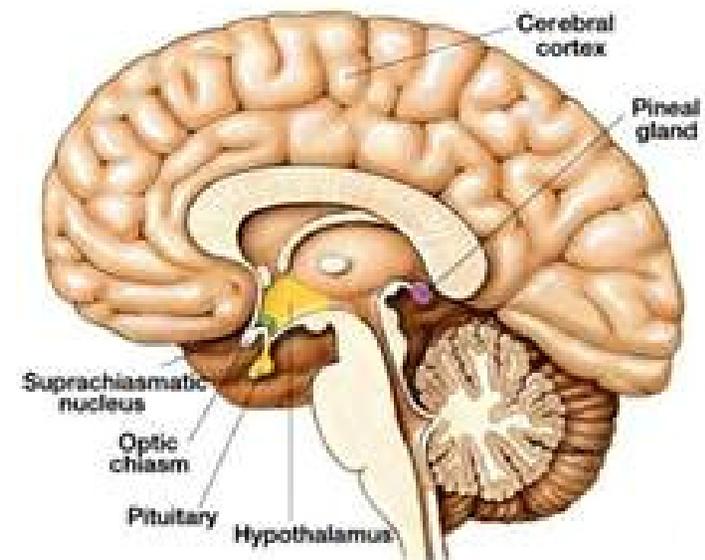
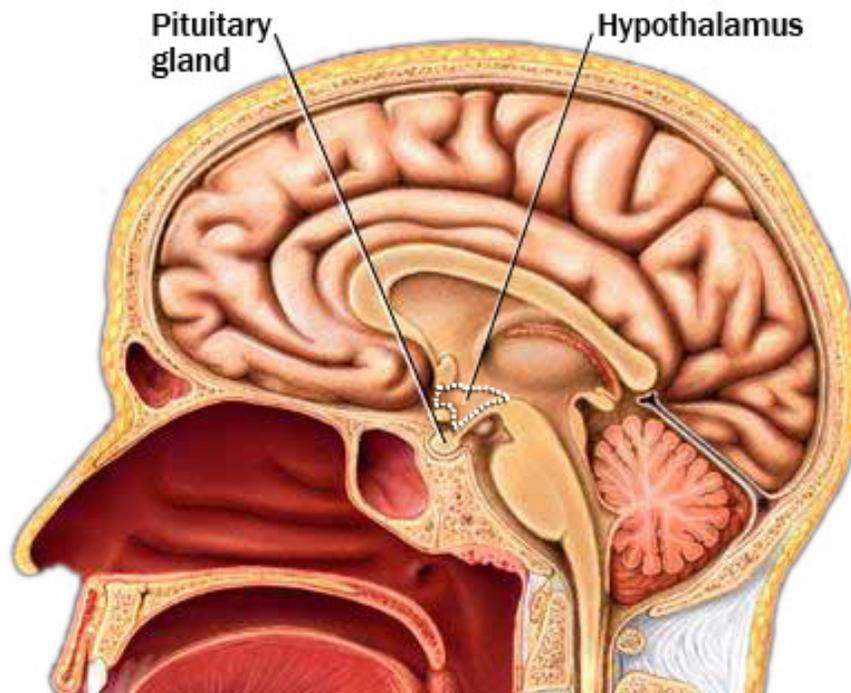
Glândulas Endócrinas
(organismo inteiro)

Células Enteroendócrinas
(isoladas no T. Digestório)

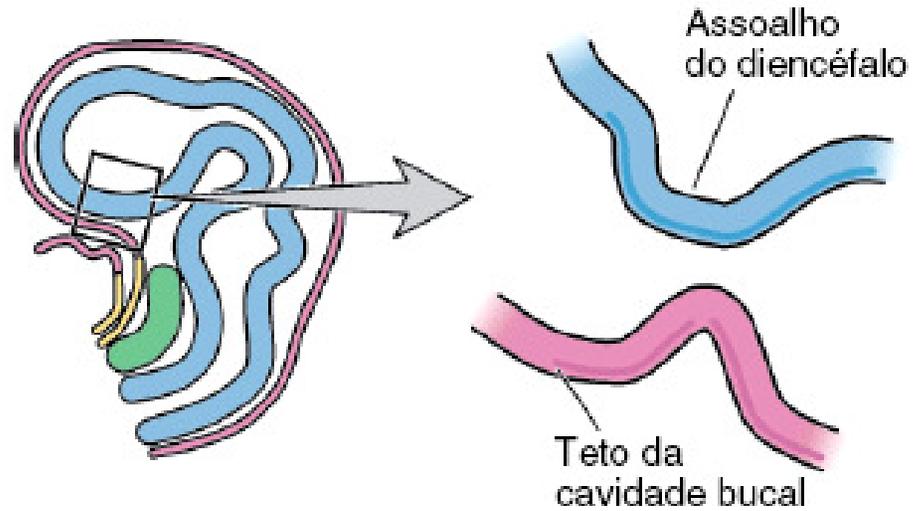
Sistema Endócrino

Hipófise (pituitária)

- base do cérebro: associada ao hipotálamo (sella túrcica)
- epitelial = adenohipófise (estomodeo)
- nervosa = neurohipófise (diencéfalo primitivo)



Hipófise:
Origem embriológica



epitelial = **adenohipófise** (estomodeo)
nervosa = **neurohipófise** (diencefalo primitivo)

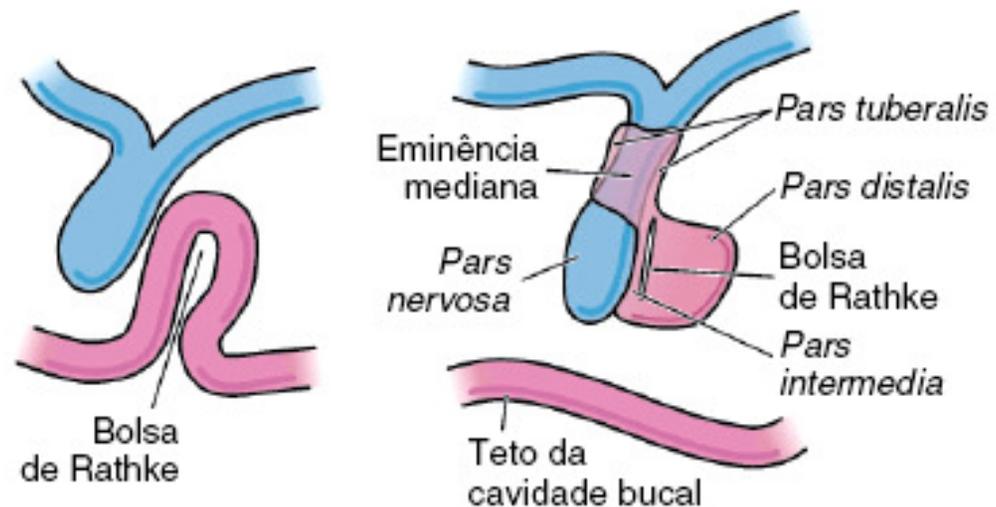


Fig. 20.1 Desenvolvimento embrionário da adeno-hipófise e da neuro-hipófise a partir do ectoderma do teto da cavidade oral e do assoalho do diencefalo.

Sistema Endócrino

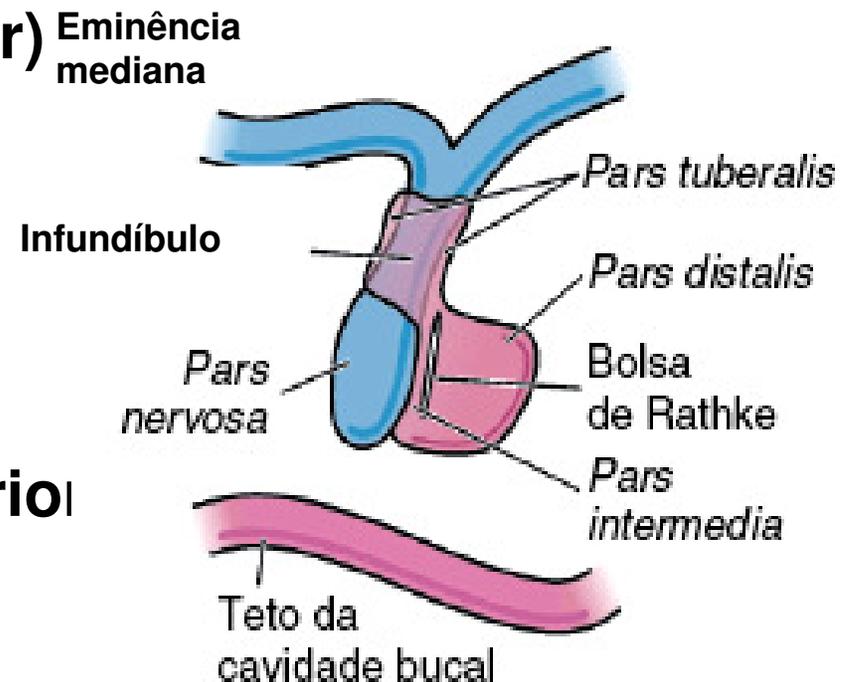
Hipófise (pituitária)

Adenohipófise

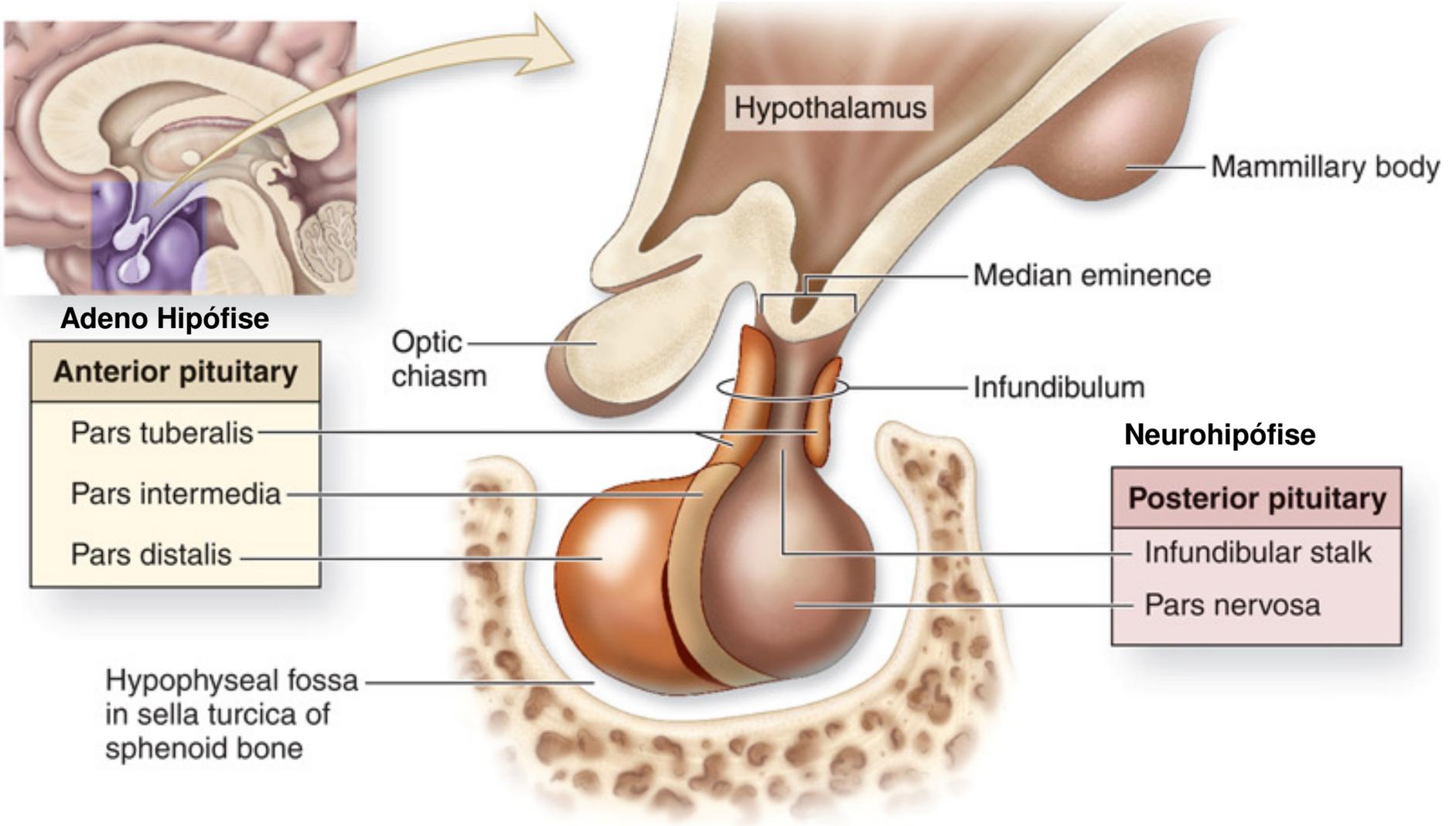
- Pars distalis (hipófise anterior)
- Pars intermedia,
- Pars tuberalis

Neurohipófise

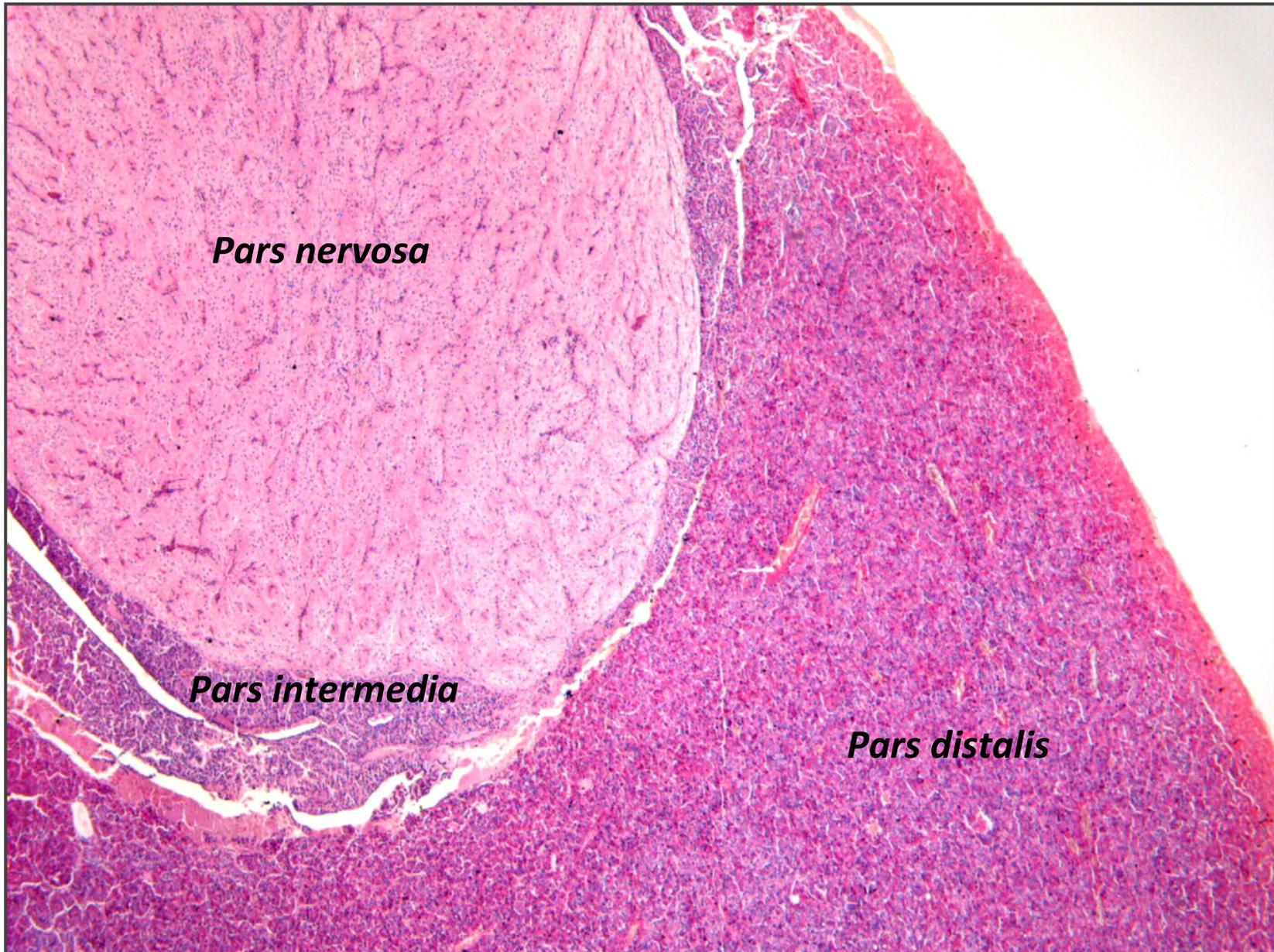
- Pars nervosa (hipófise posterior)
- Infundíbulo
- Eminência Média

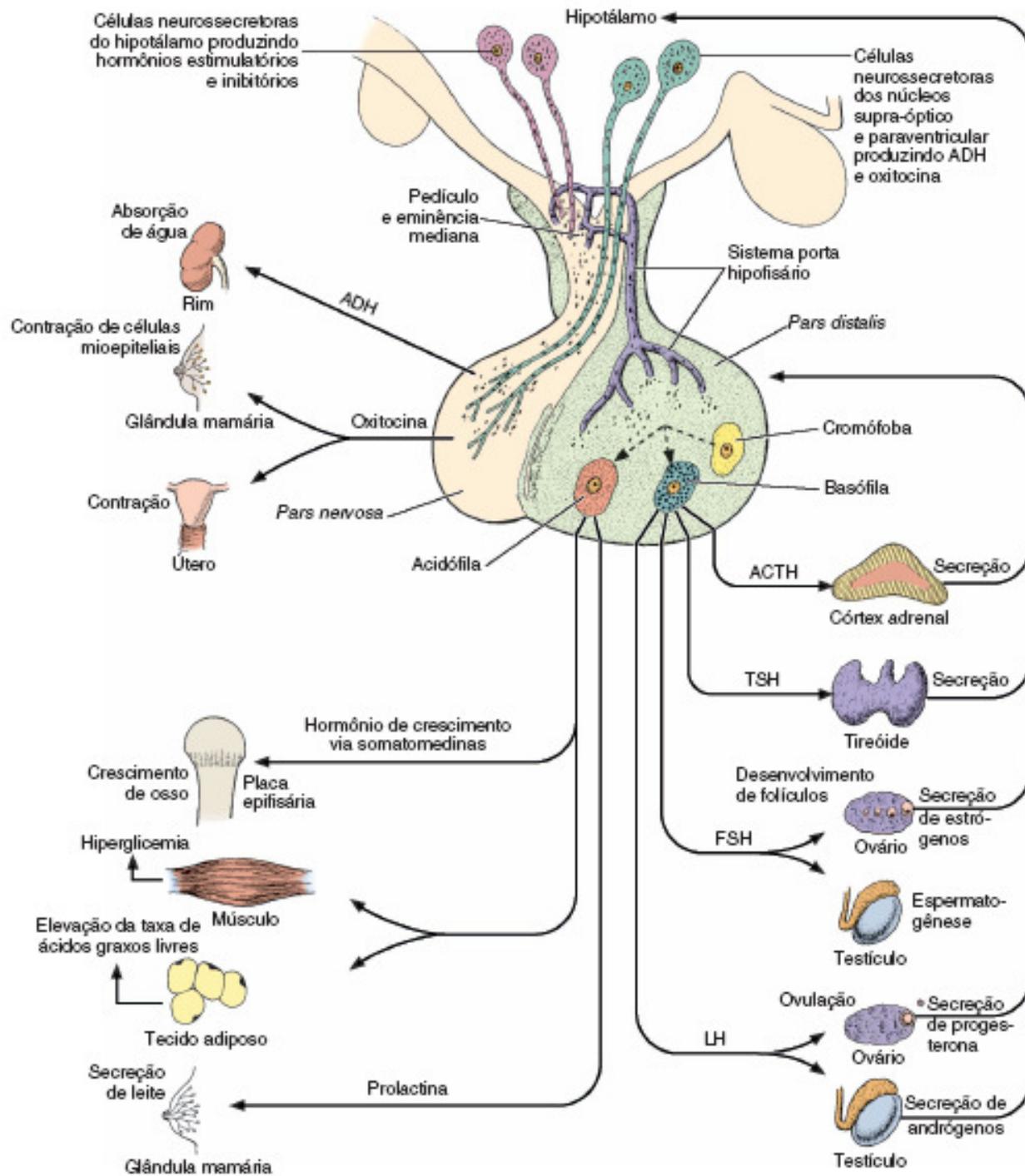


Hipófise (pituitária)



Hipófise (pituitária)





Sistema Endócrino

Adenohipófise: Glândula endócrina cordonal: tipos de células

Pars distalis

Cromófilas

Células acidófilas

- somatotróficas- GH
- mamotrólicas ou lactotrólicas (prolactina)

Células basófilas

- adenocorticolipotrólicas – ACTH, lipotrofinas
- tireotrólicas - TSH
- gonadotrólicas – FSH, LH

Cromófobas – sem secreção

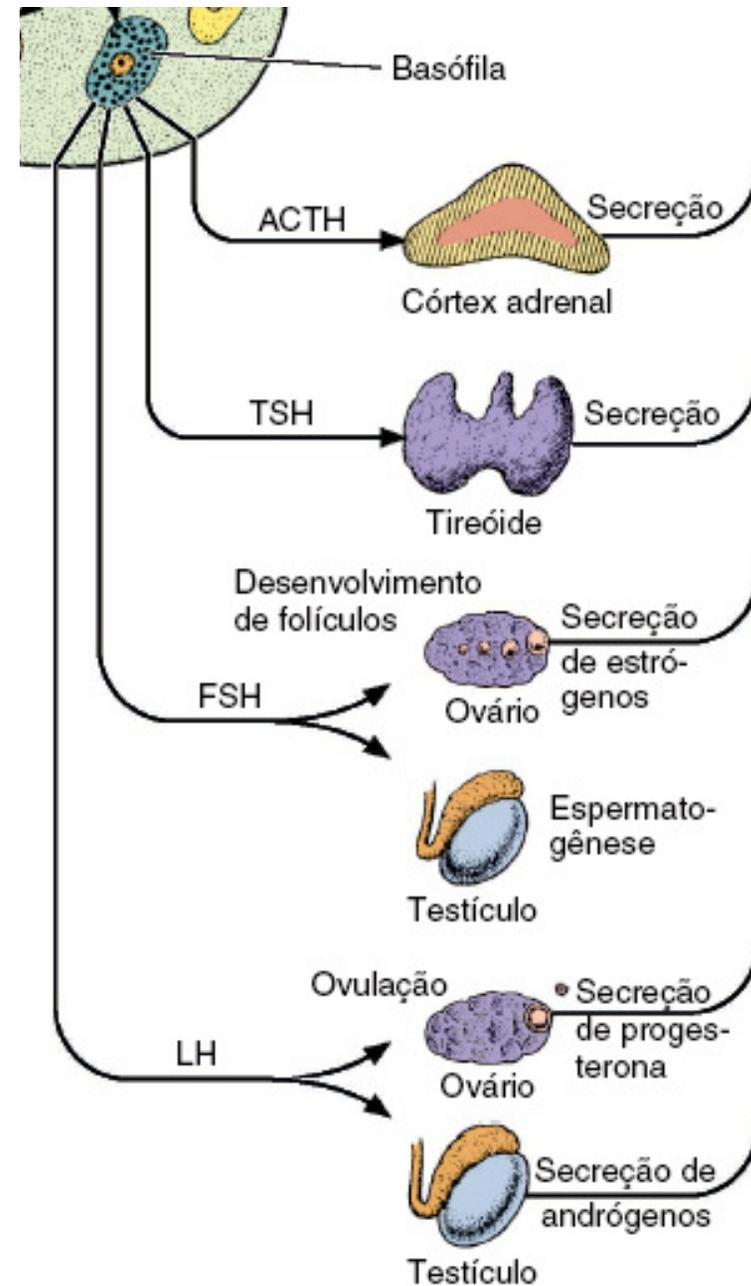
Sistema Endócrino

Adenohipófise: tipos de células

Pars distalis

Cromófilas basófilas

- adenocorticolipotróficas – ACTH
- tireotróficas - TSH
- gonadotróficas – FSH, LH



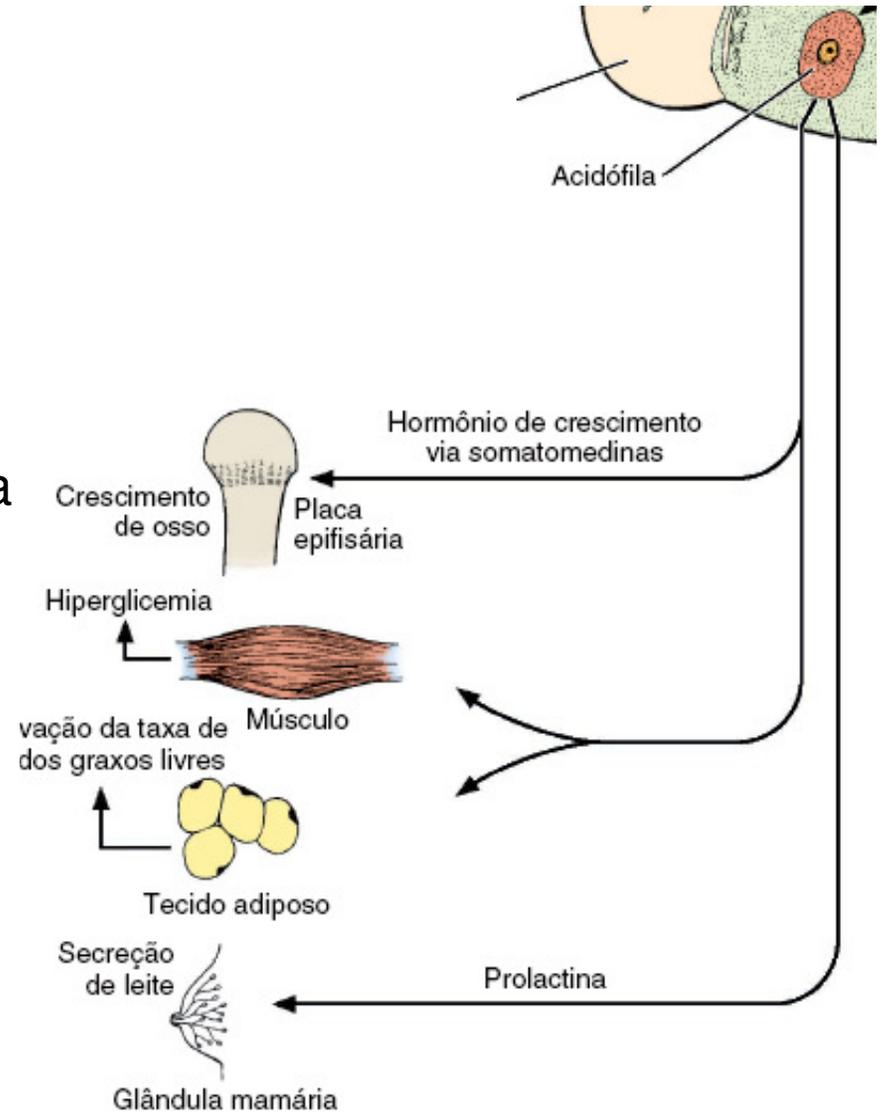
Sistema Endócrino

Adenohipófise: tipos de células

Pars distalis

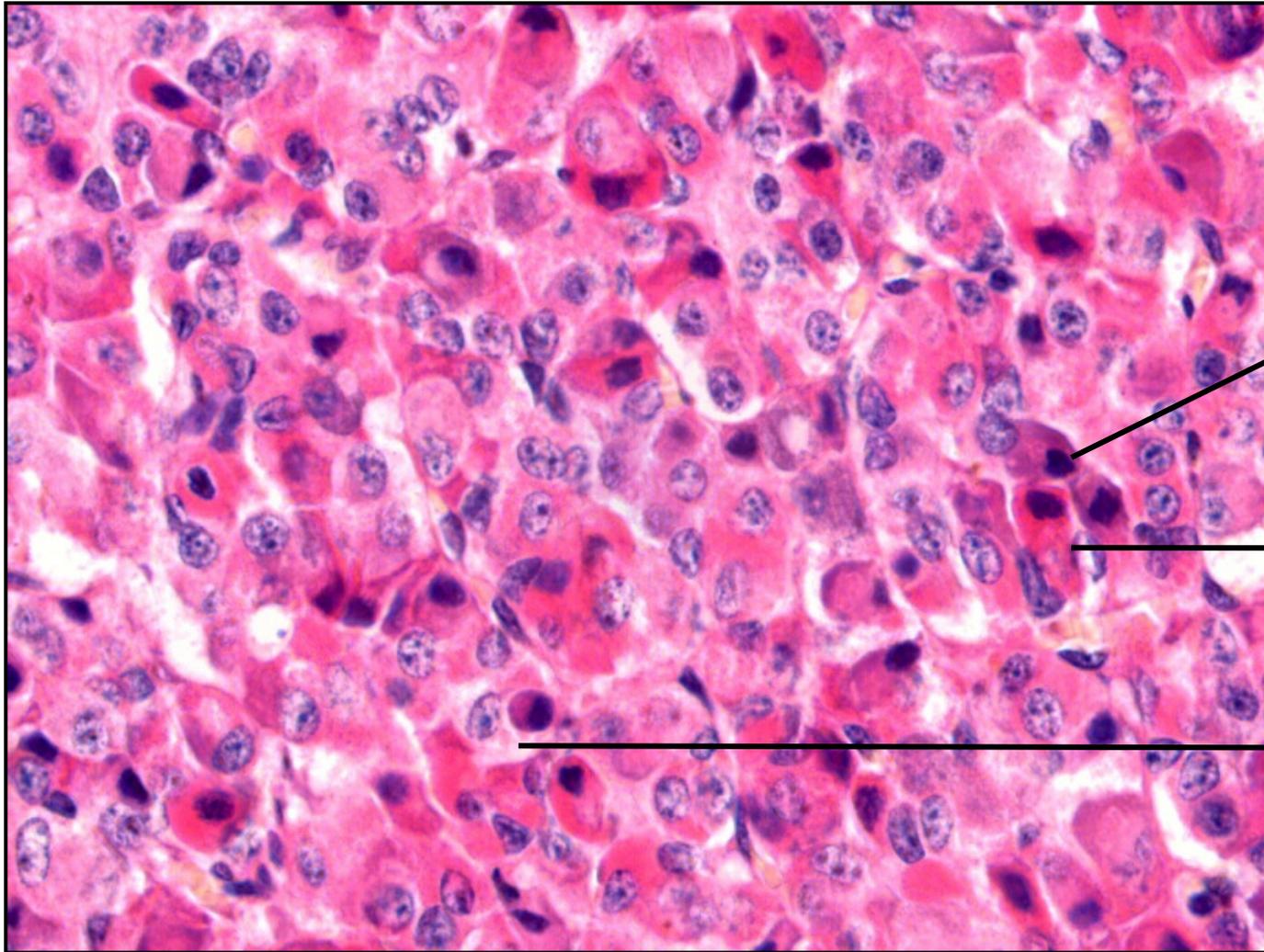
Cromófilas acidófilas

- Somatotróficas - GH
- mamotrólicas ou lactotróficas - Prolactina



Sistema Endócrino

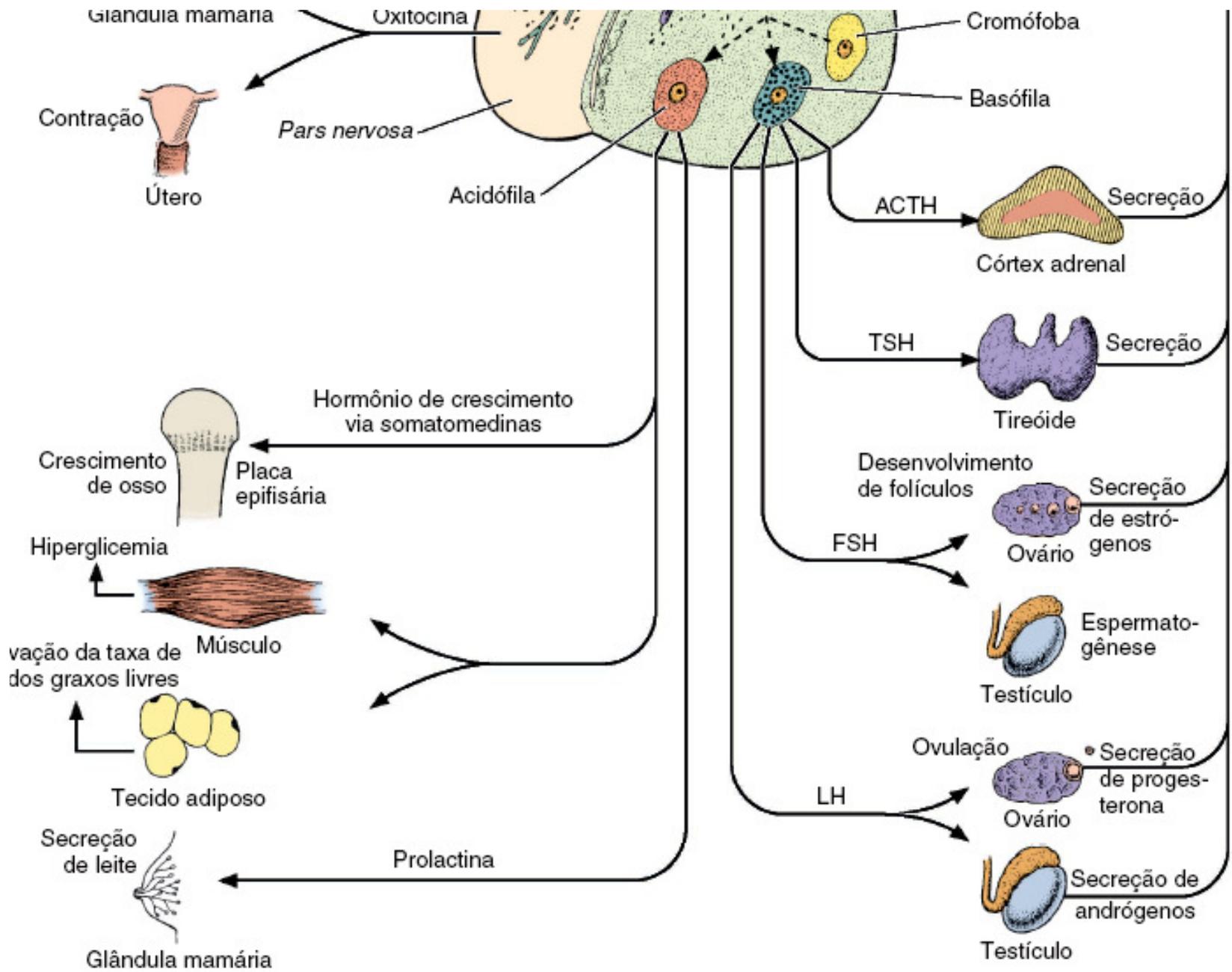
Adenohipófise



**CROMÓFILA
BASÓFILA**

**CROMÓFILA
ACIDÓFILA**

CROMÓFOBA



Sistema Endócrino

➤ Adenohipófise

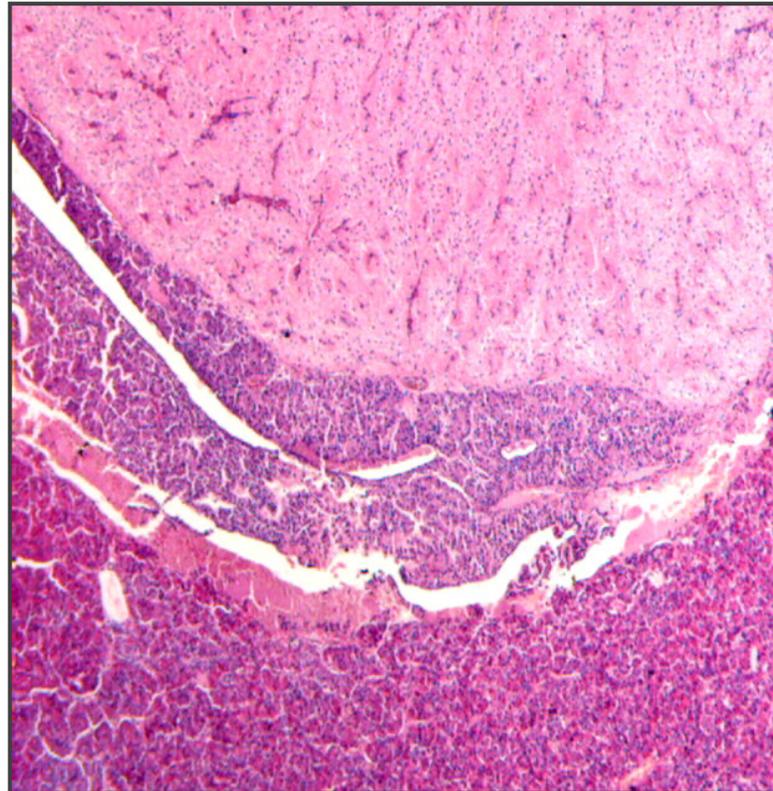
Pars intermedia

Células cromófilas

Células basófilas

- melanotróficas - MST (H. melanotrófico)
- vesículas com colóide (resquício da bolsa de Rathke)

Células cromófobas



Sistema Endócrino

➤ Adenohipófise

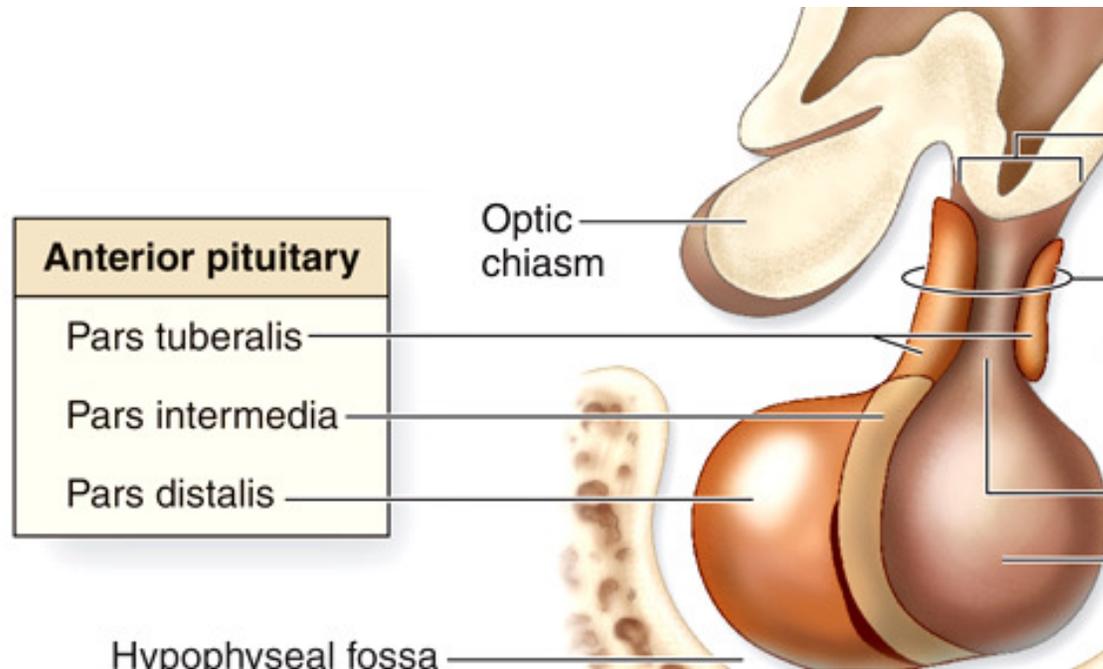
Pars tuberalis

Células cromófilas

Células basófilas

- gonadotróficas – FSH, LH

Células cromófobas



CONTROLE FUNCIONAL DA *PARS DISTALIS*

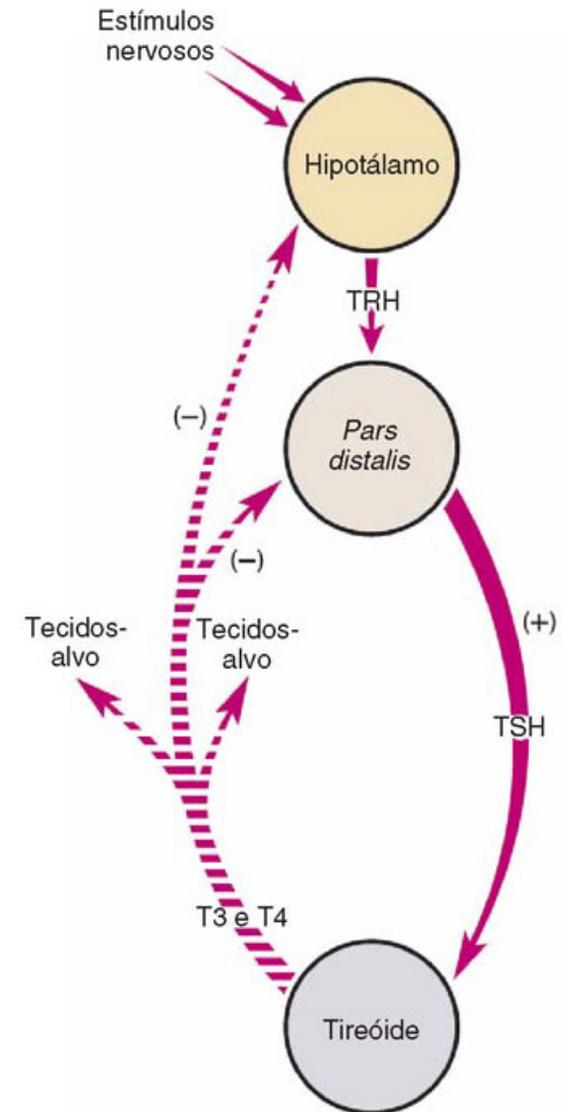
Produção do TSH – Hormônio Estimulante da Tireóide

✓ Mecanismo principal: **HIPOTÁLAMO**

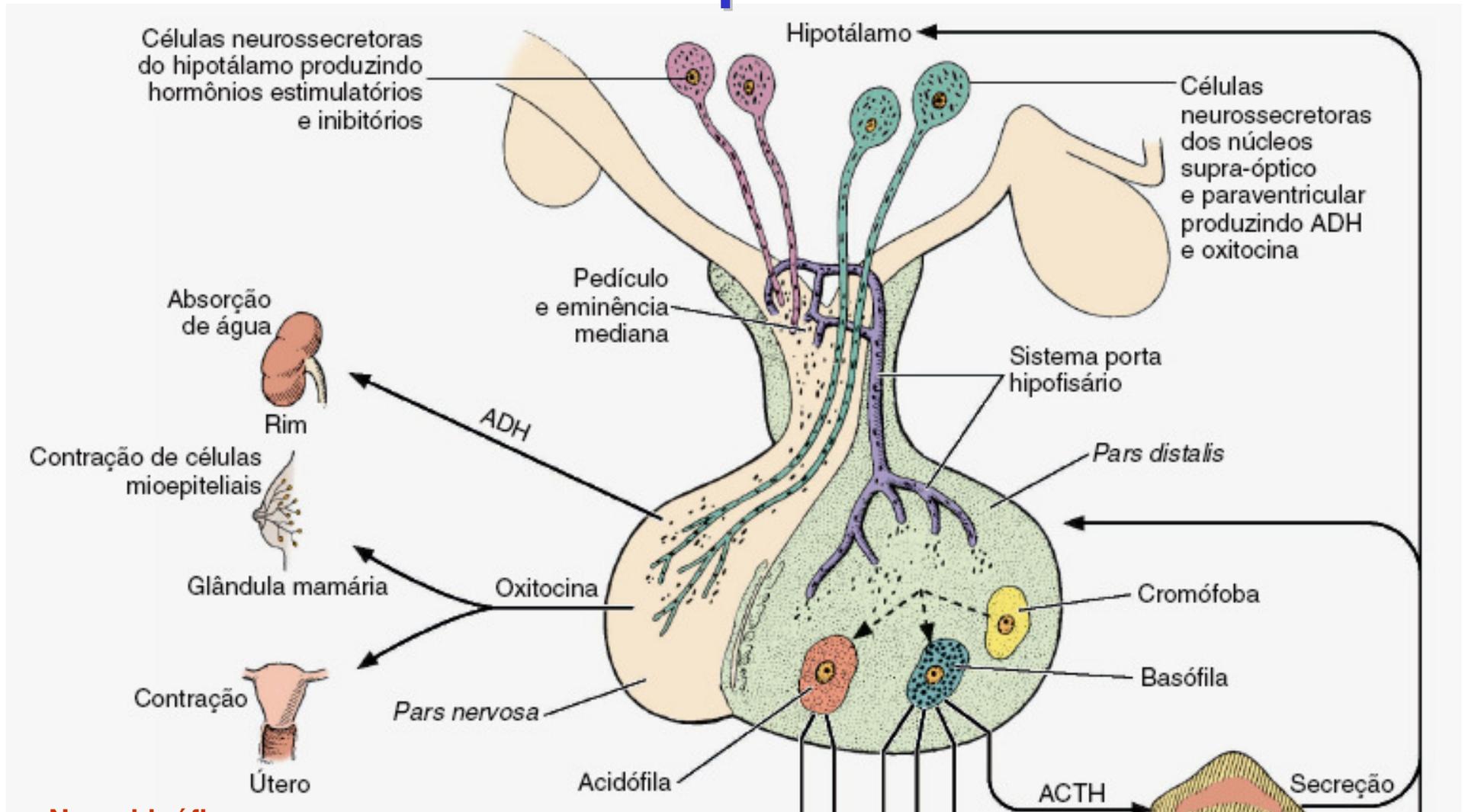


HORMÔNIOS LIBERADORES
HIPOTALÂMICOS

✓ Mecanismo de *Feedback*



Neurohipófise



Neurohipófise

- Pars nervosa (hipófise posterior)
- Infundíbulo
- Eminência Média

Sistema Endócrino

➤ Neurohipófise

Componentes:

Fibras amielínicas

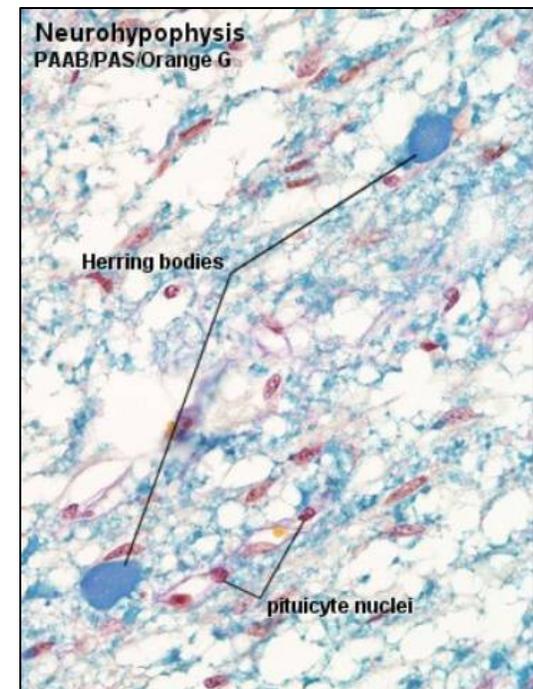
- corpos de Herring (oxitocina, ADH- neurofisinas)
- origem – corpos celulares de neurônios dos núcleos paraventricular e supra-óptico

Pituícitos (células estruturais)

Capilares fenestrados

Neurohipófise

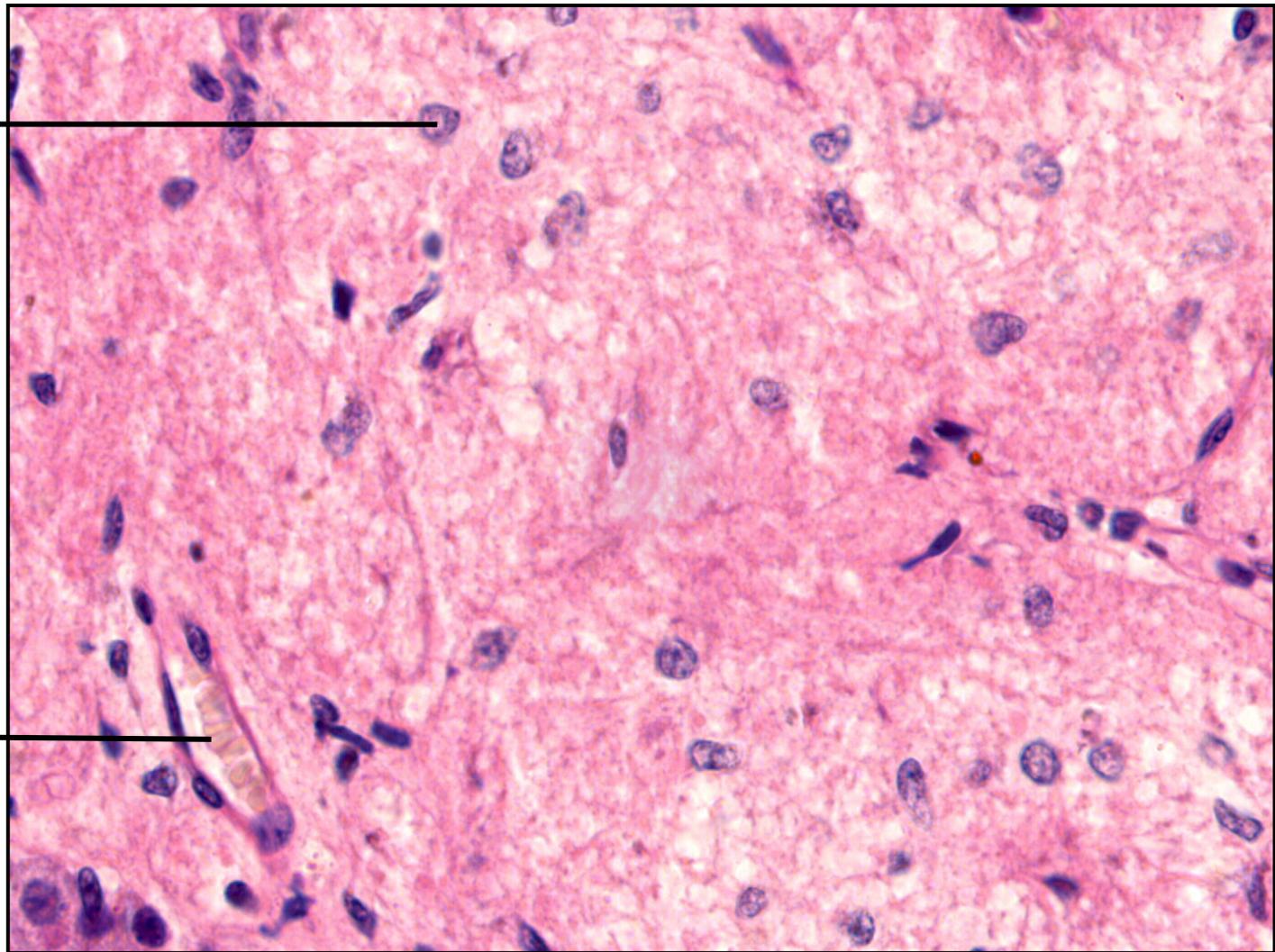
- Pars nervosa (hipófise posterior)
- Infundíbulo
- Eminência Media



NEURO-HIPÓFISE

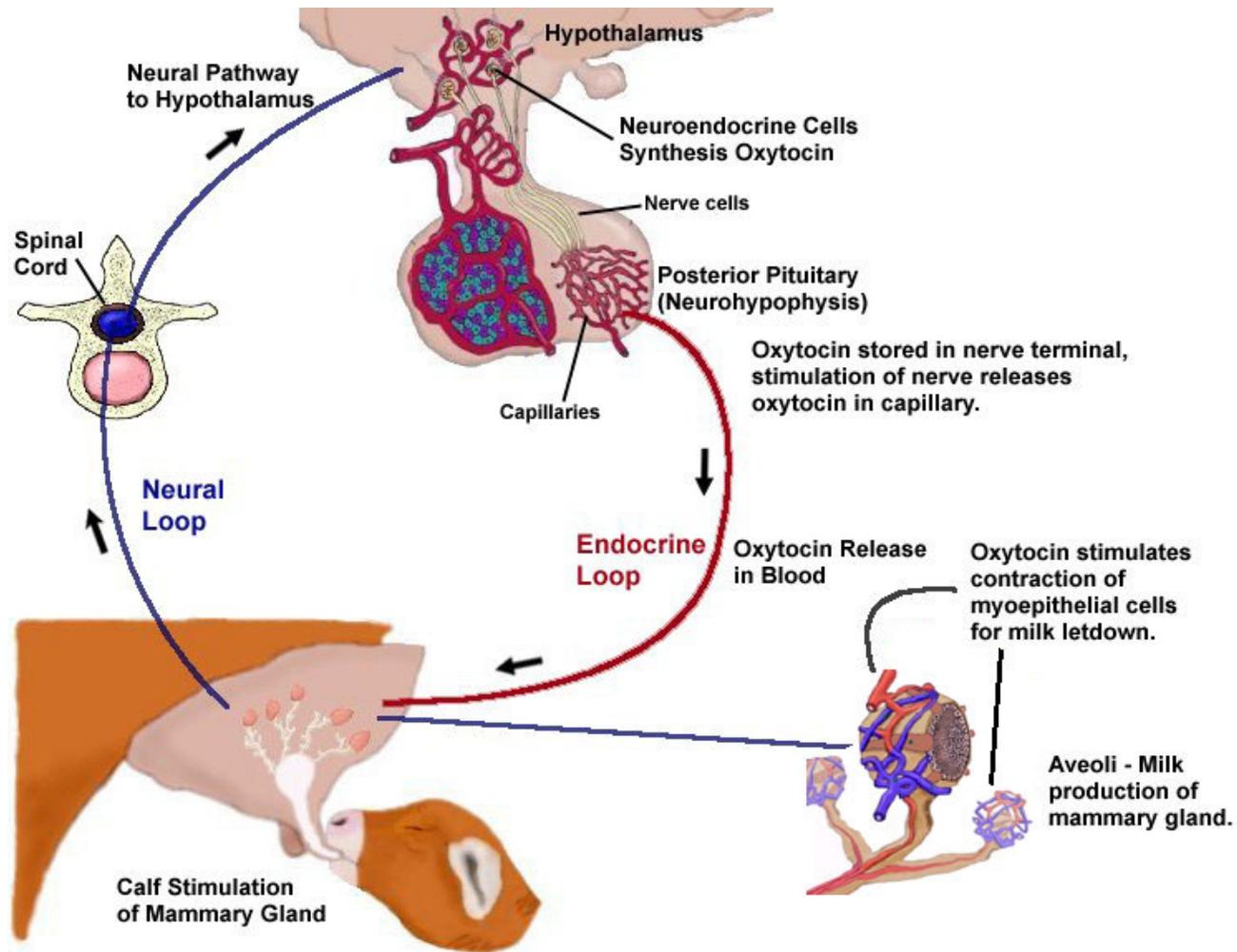
Pituícitos
(Glial)

Vasos

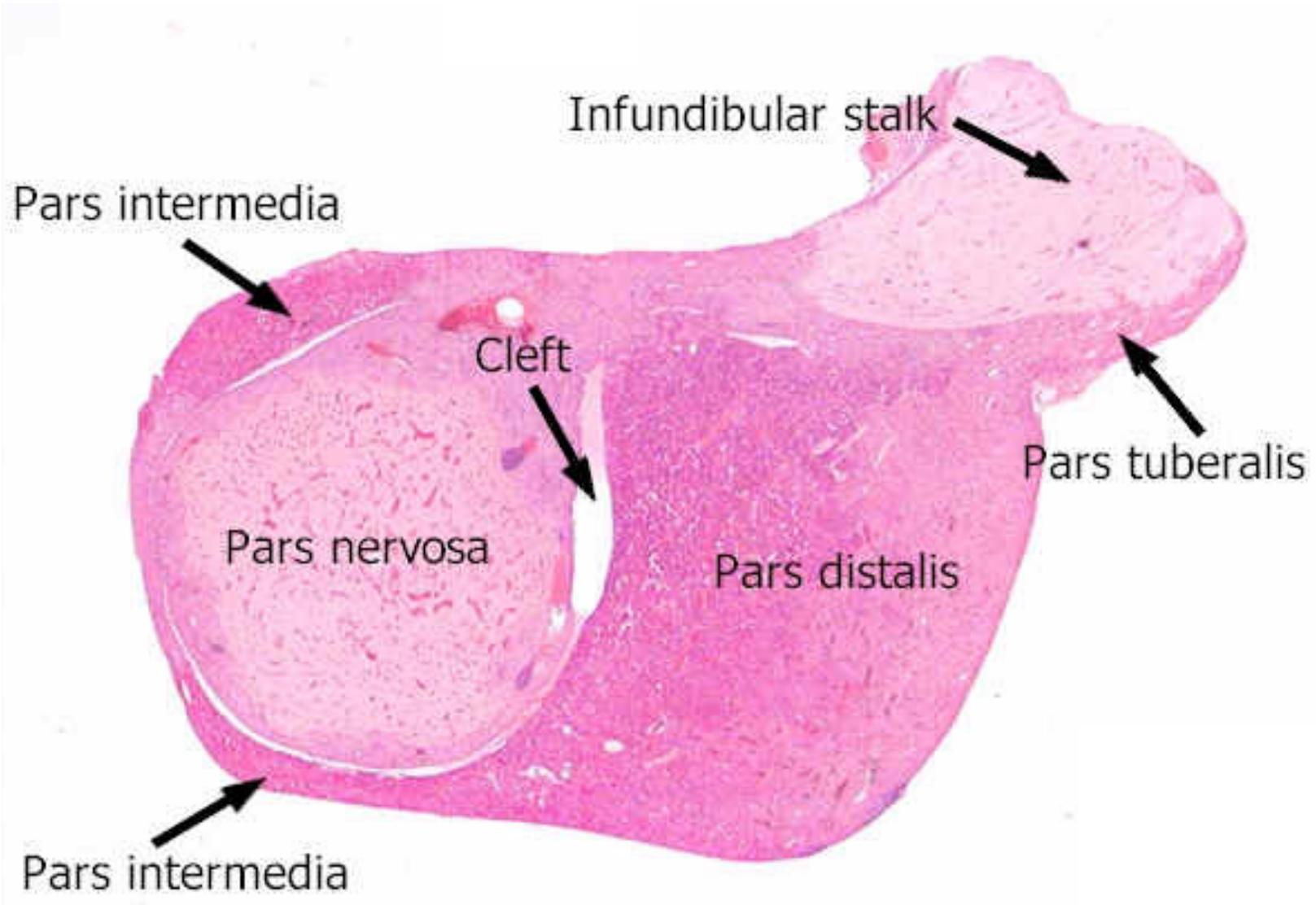


CONTROLE FUNCIONAL DA *PARS NERVOSA*

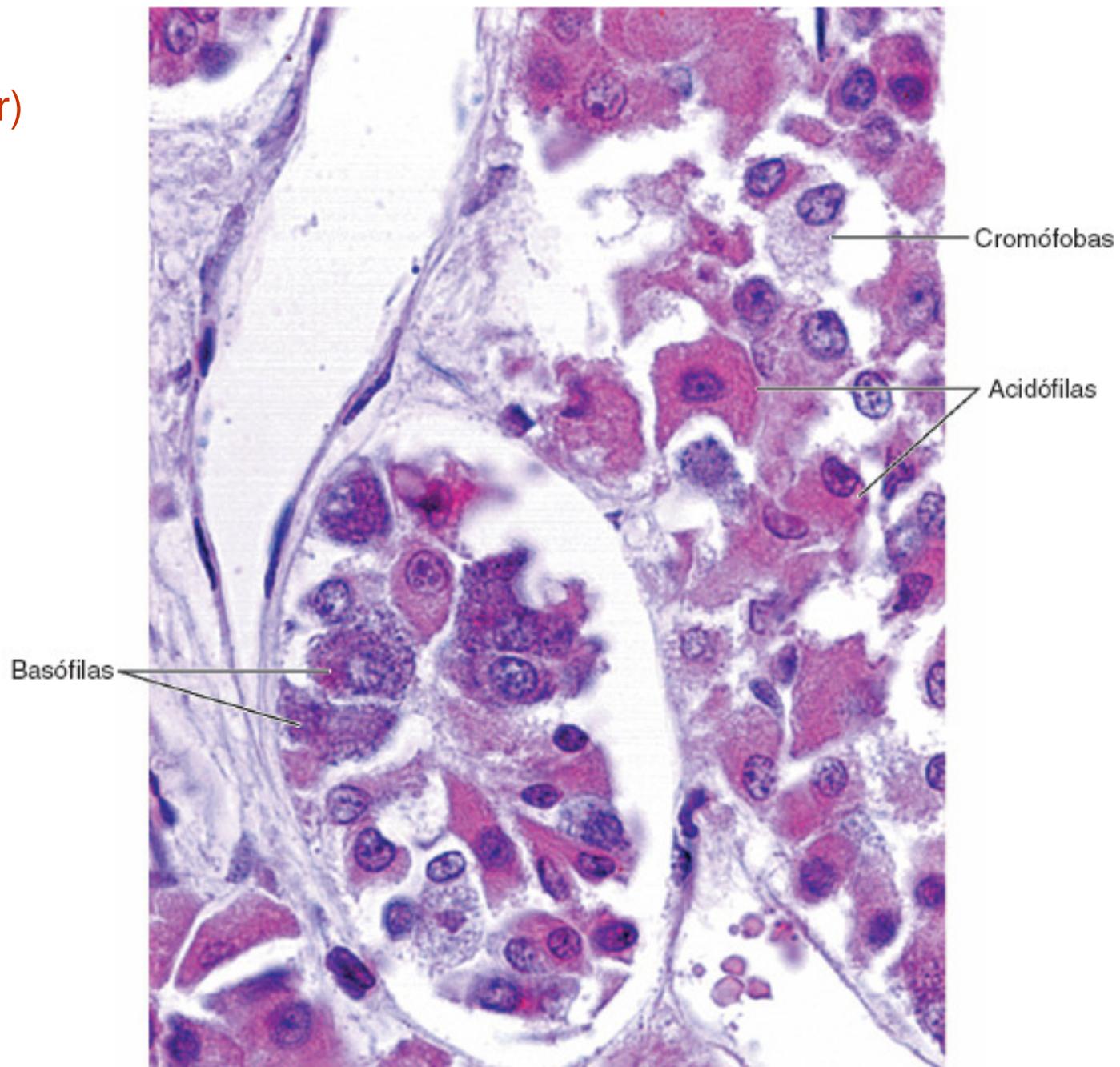
Produção de Leite - OXITOCINA



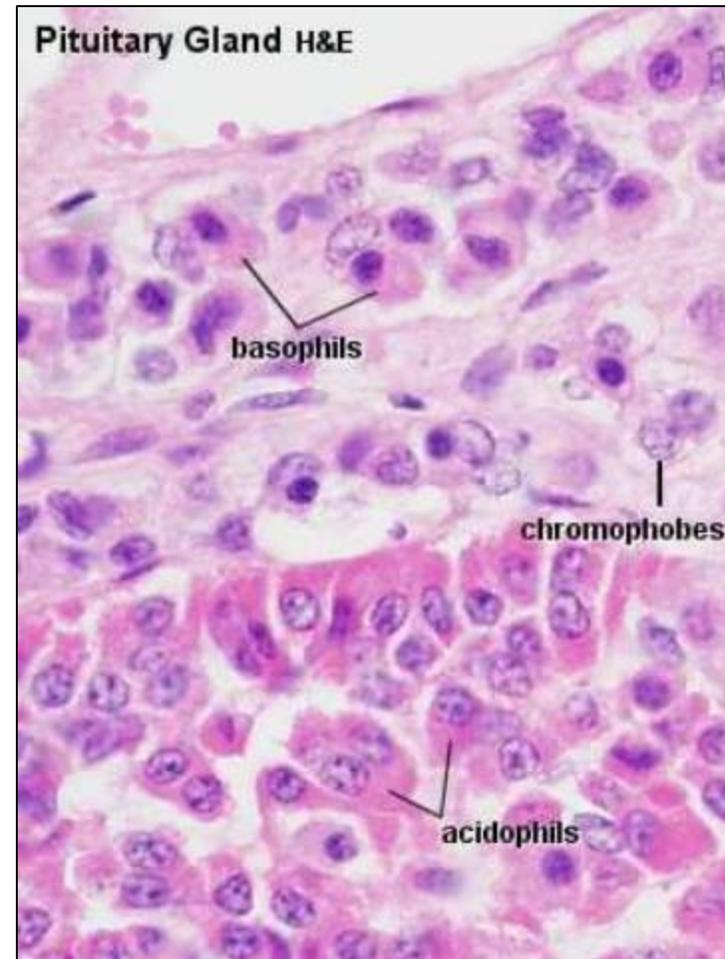
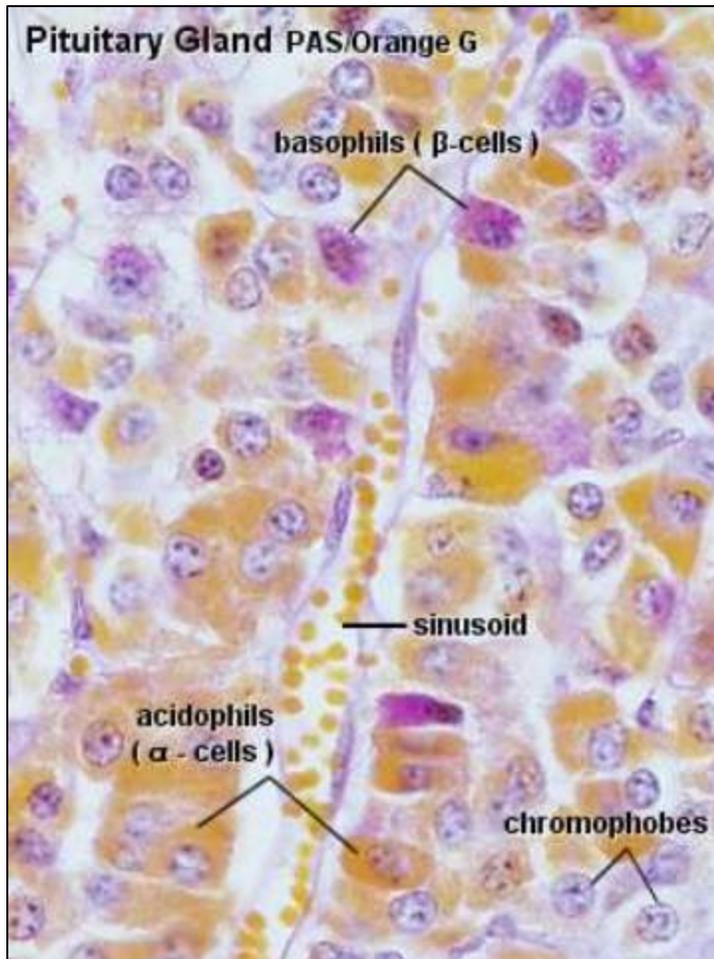
Hipófise



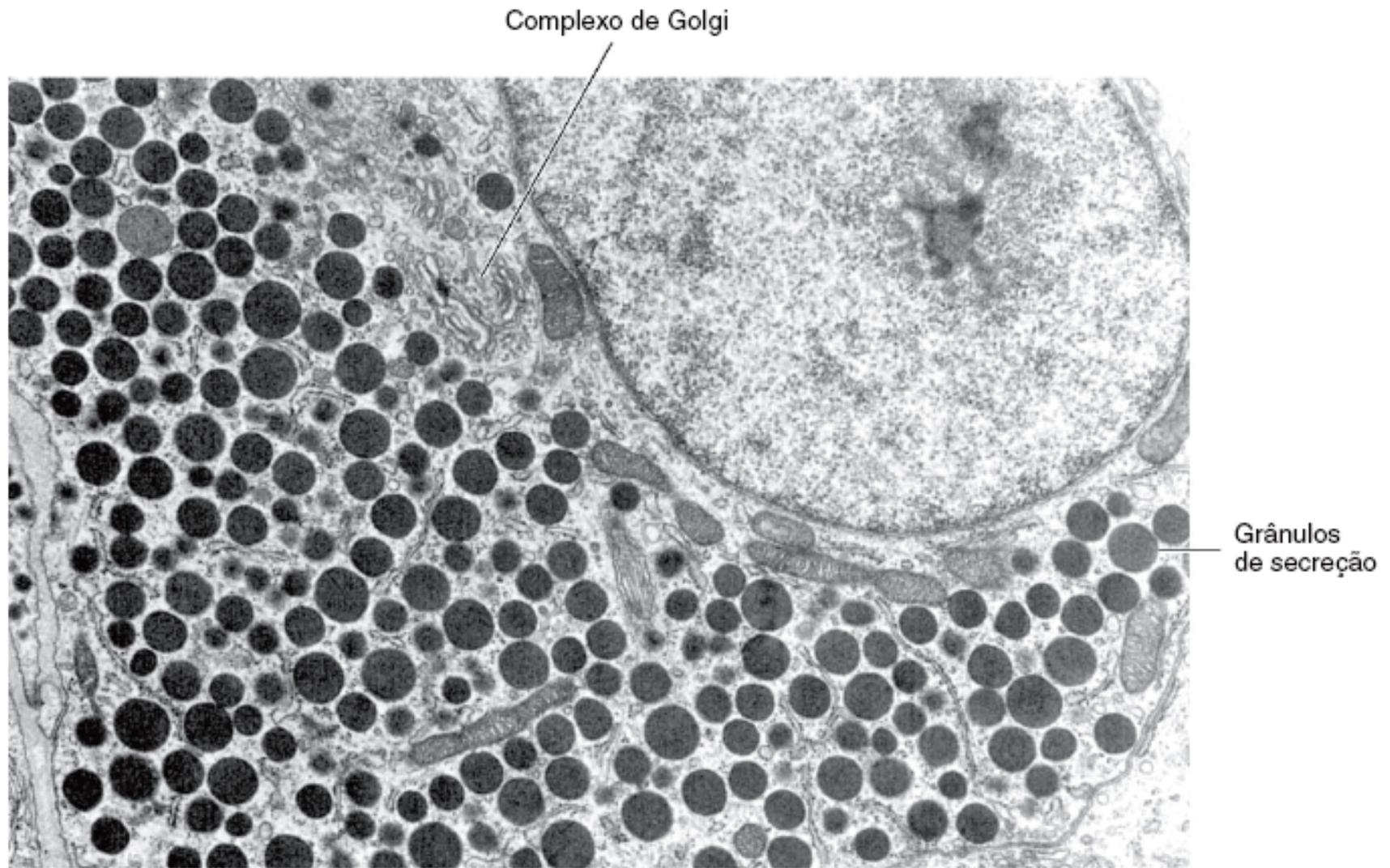
Pars distalis
(hipófise anterior)



Pars distalis (hipófise anterior)

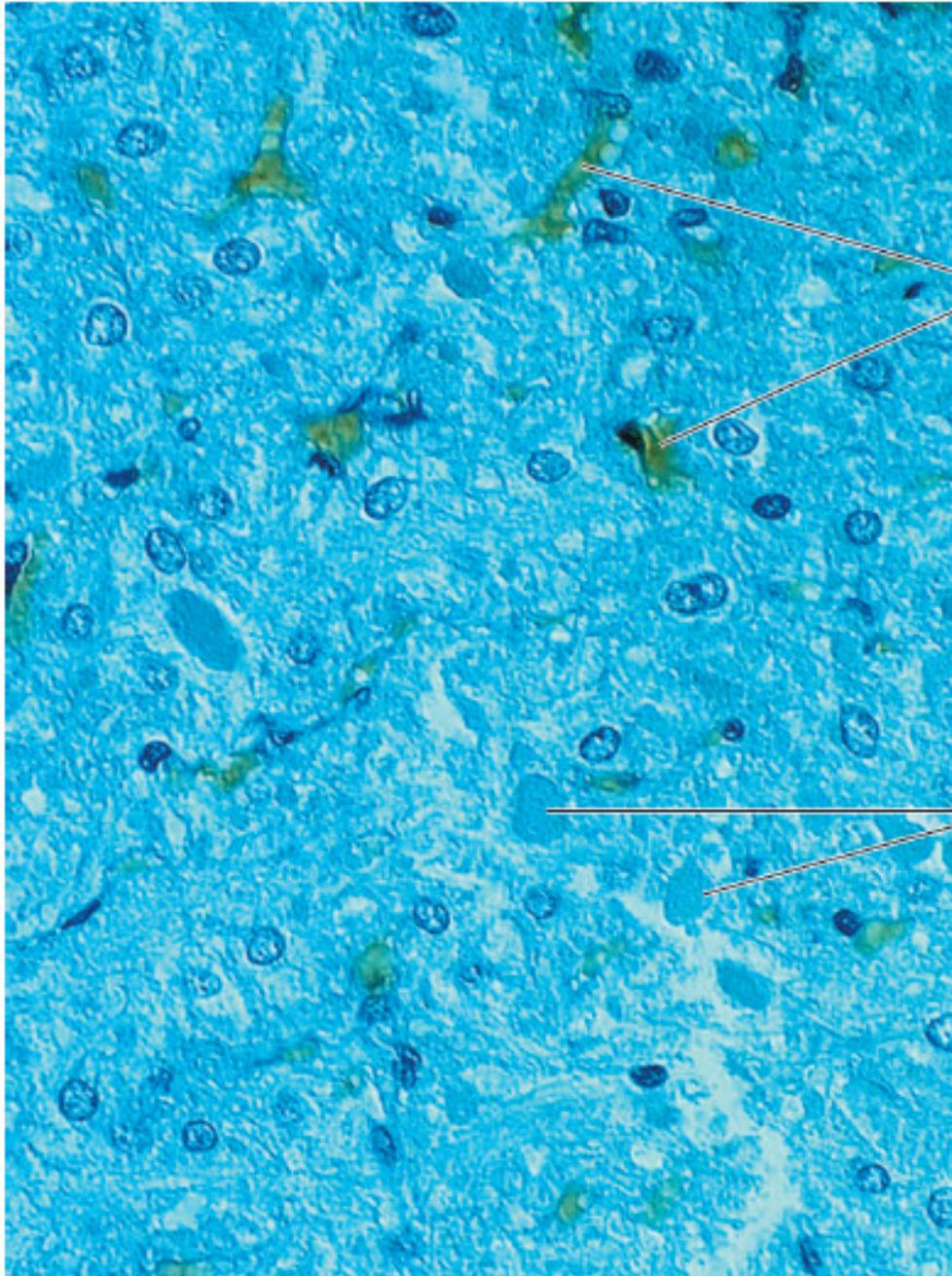


Pars distalis (hipófise anterior)



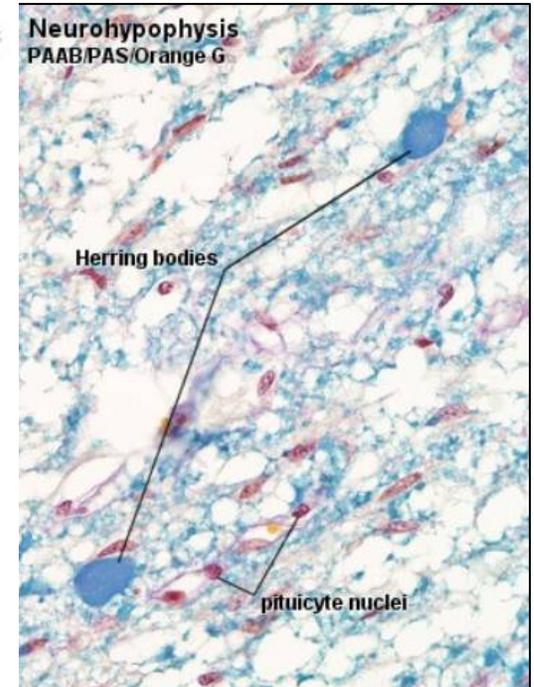
Célula somatotrófica: acidófila

Pars nervosa (hipófise posterior)



Capilares
sanguíneos

Corpos de
Herring

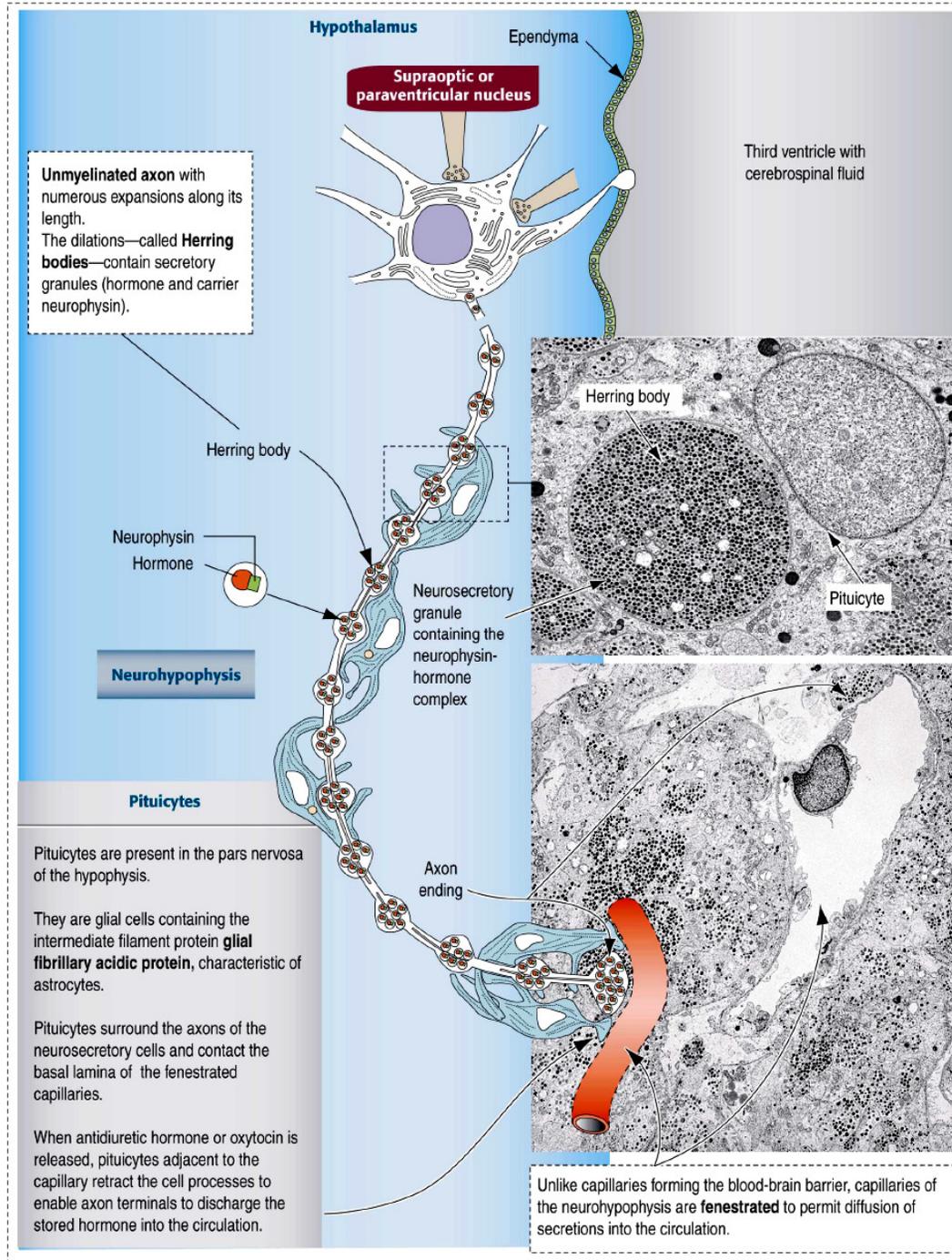


Neurohypophysis
PAAB/PAS/Orange G

Herring bodies

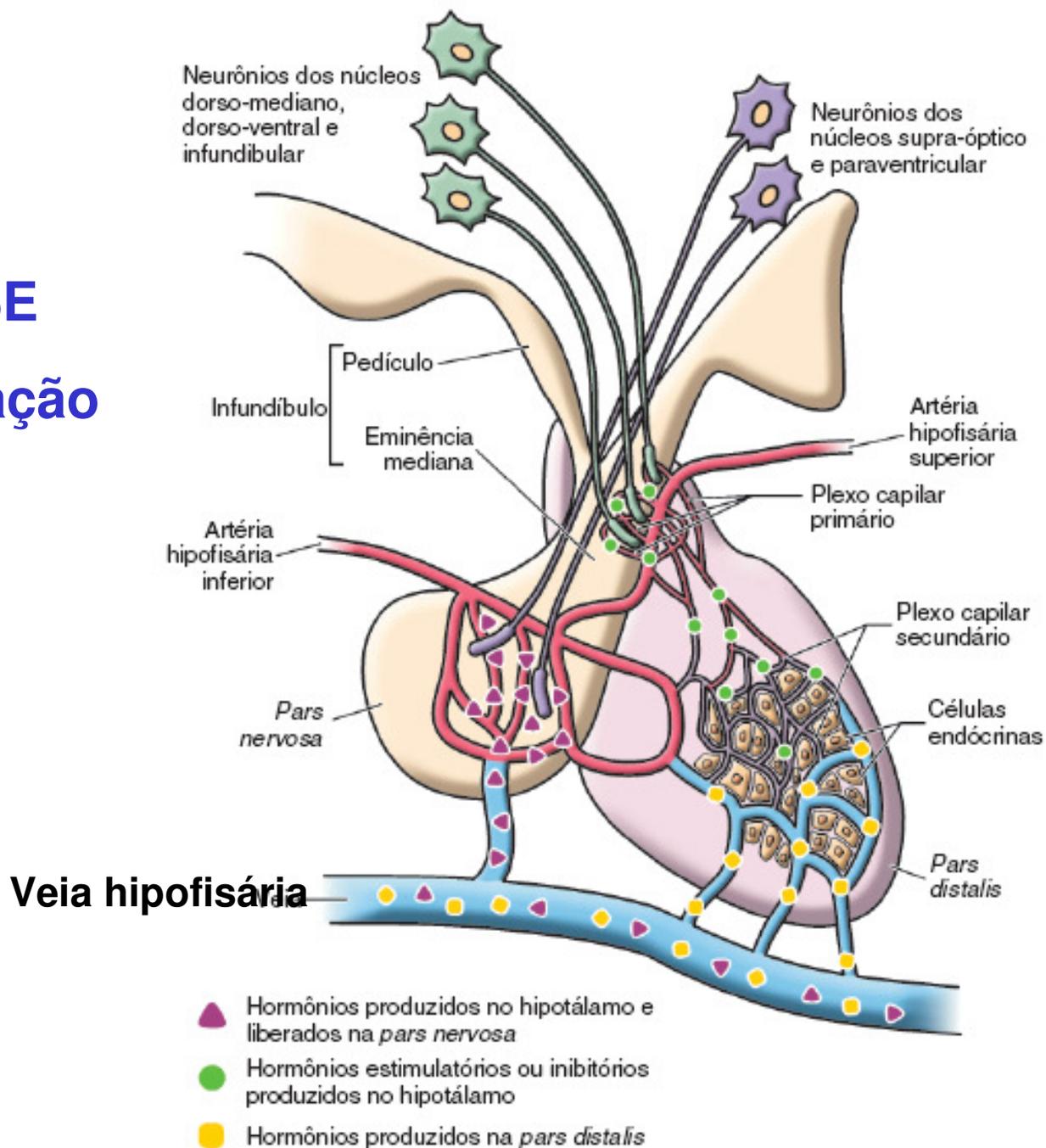
pituitary nuclei

Pars nervosa (hipófise posterior)

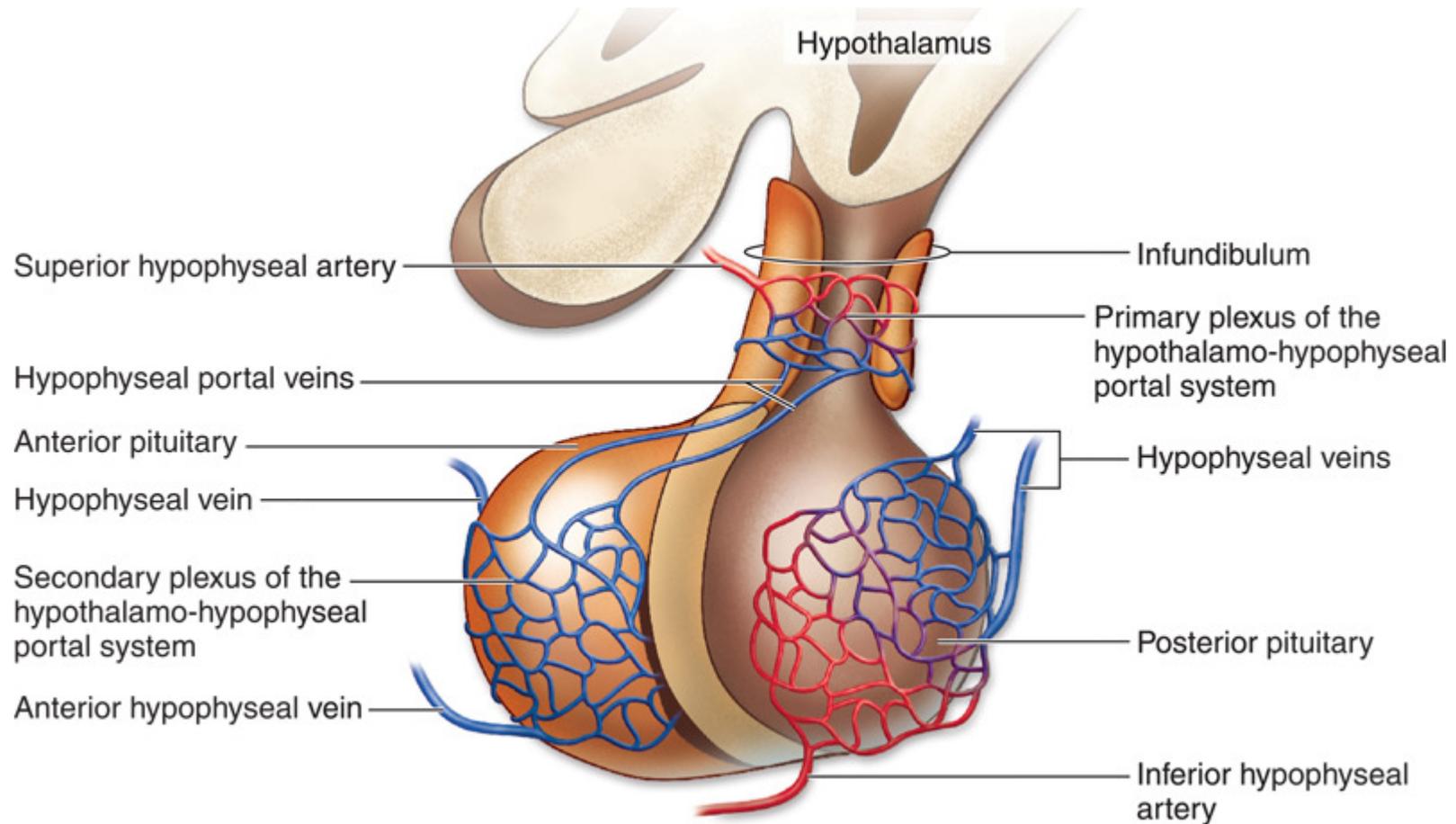


HIPÓFISE

Vascularização

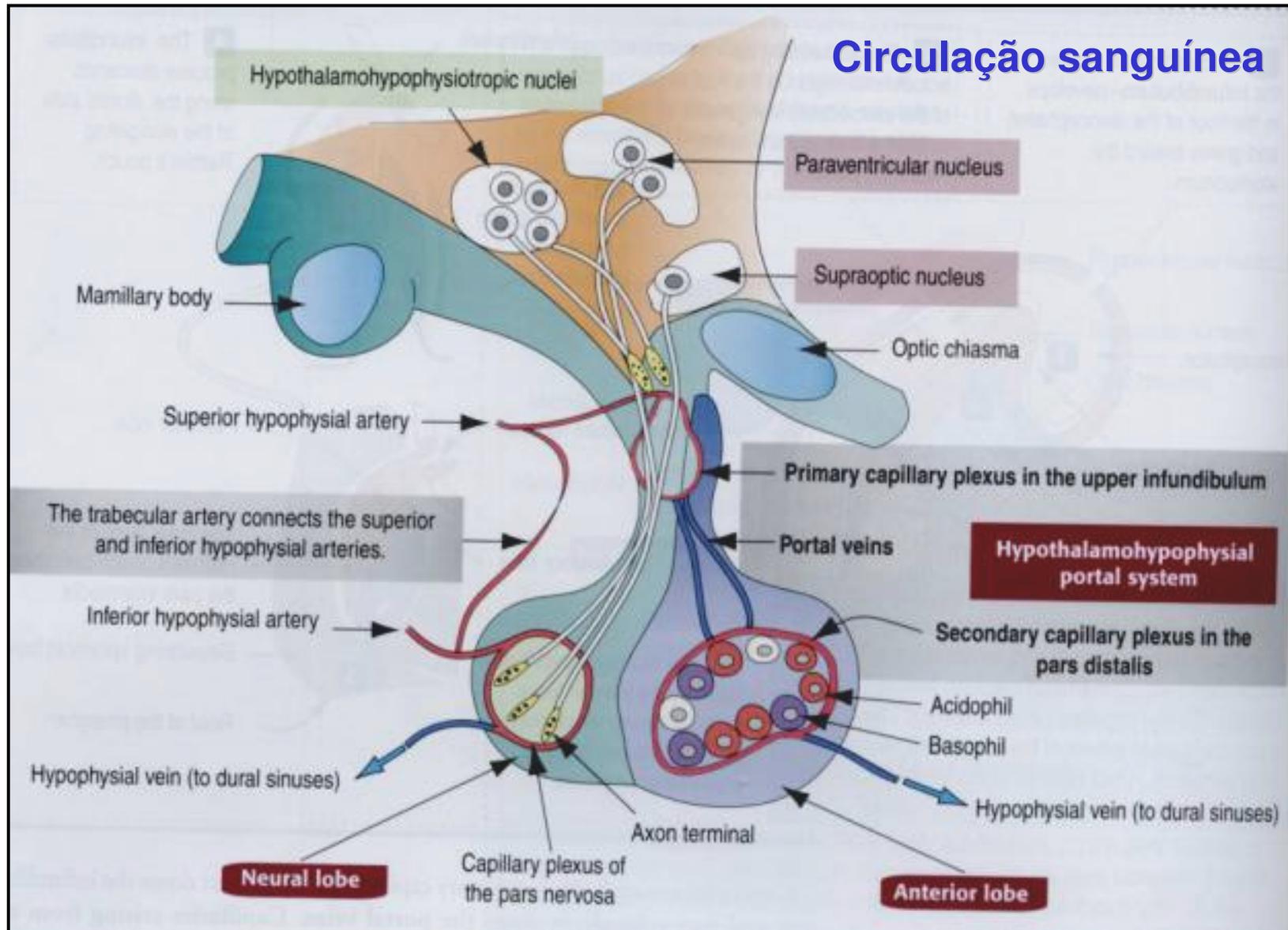


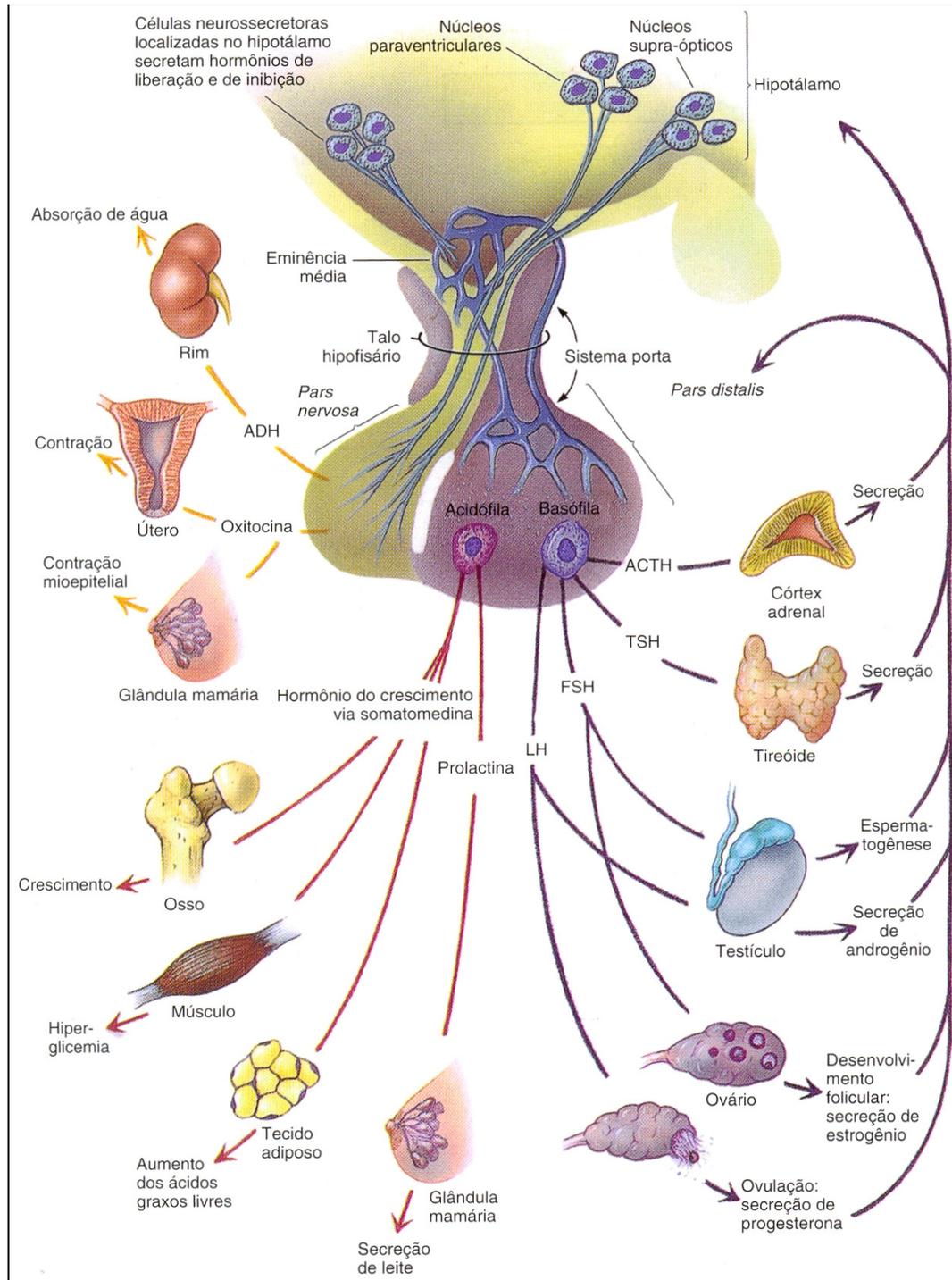
HIPÓFISE :Vascularização



(a) Hypothalamo-hypophyseal portal system

HIPÓFISE :Vascularização

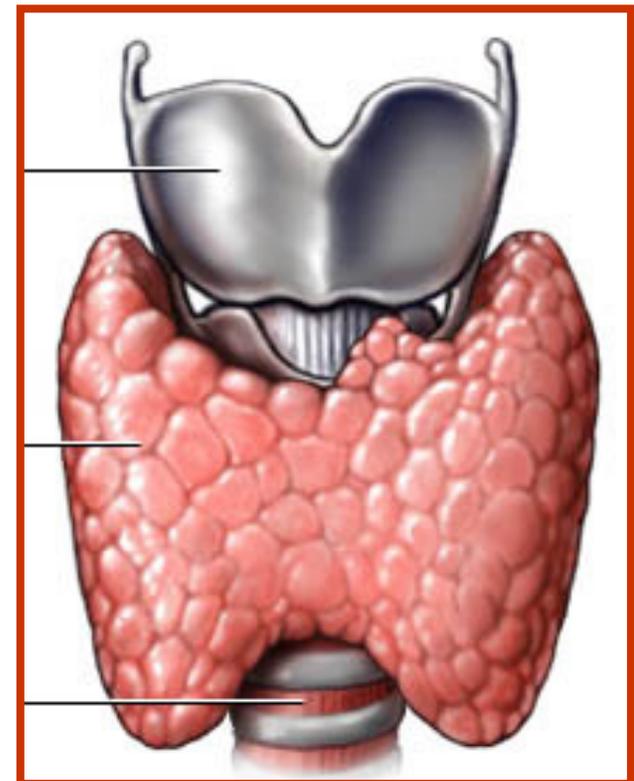
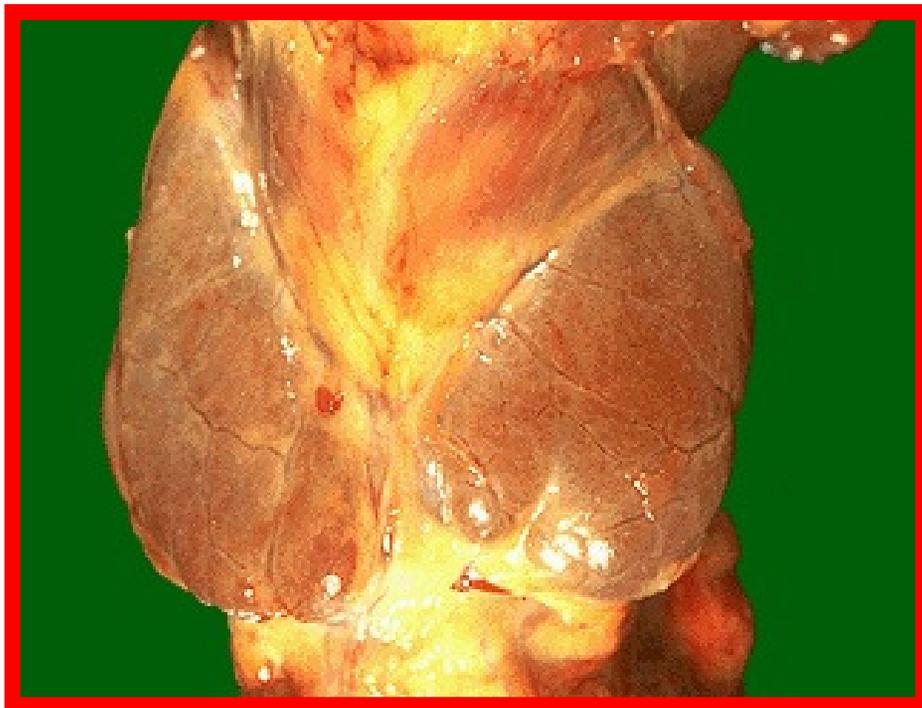




Sistema Endócrino

TIREÓIDE

- Dois lobos laterais unidos pelo istmo (lobo piramidal)
- Cápsula de TCD e trabéculas conjuntivas
- Folículos tireoidianos (colóide)
células foliculares
células parafoliculares (células C)

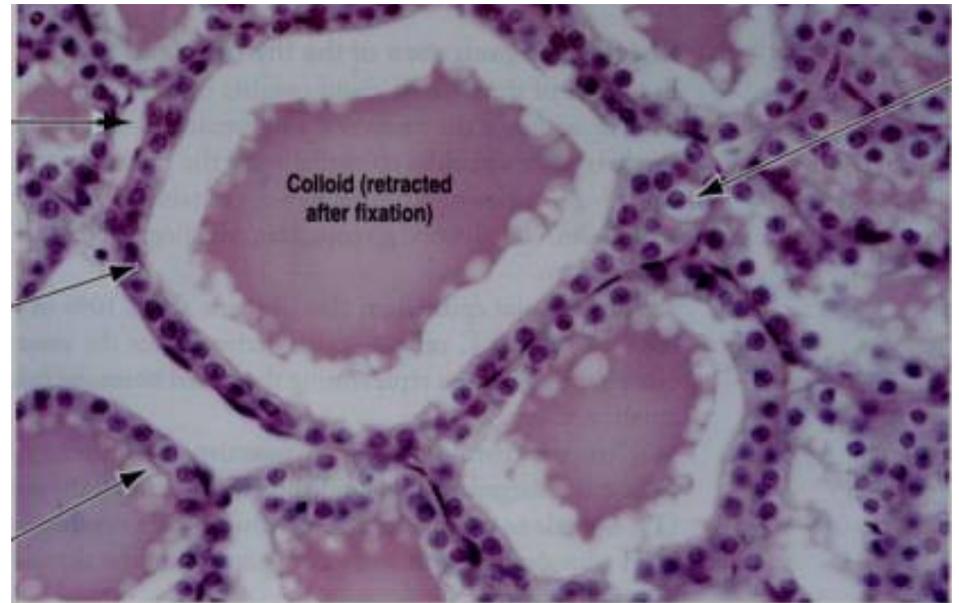
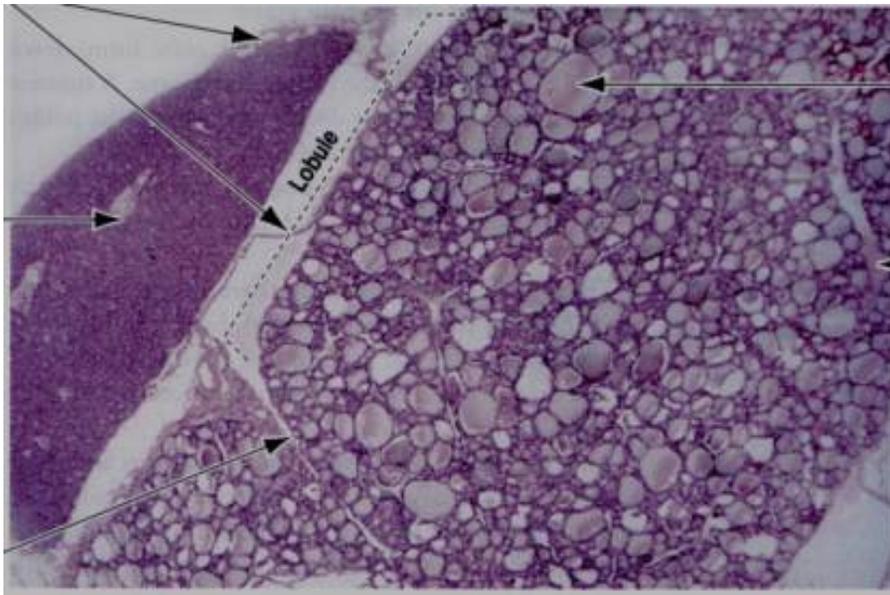


Sistema Endócrino

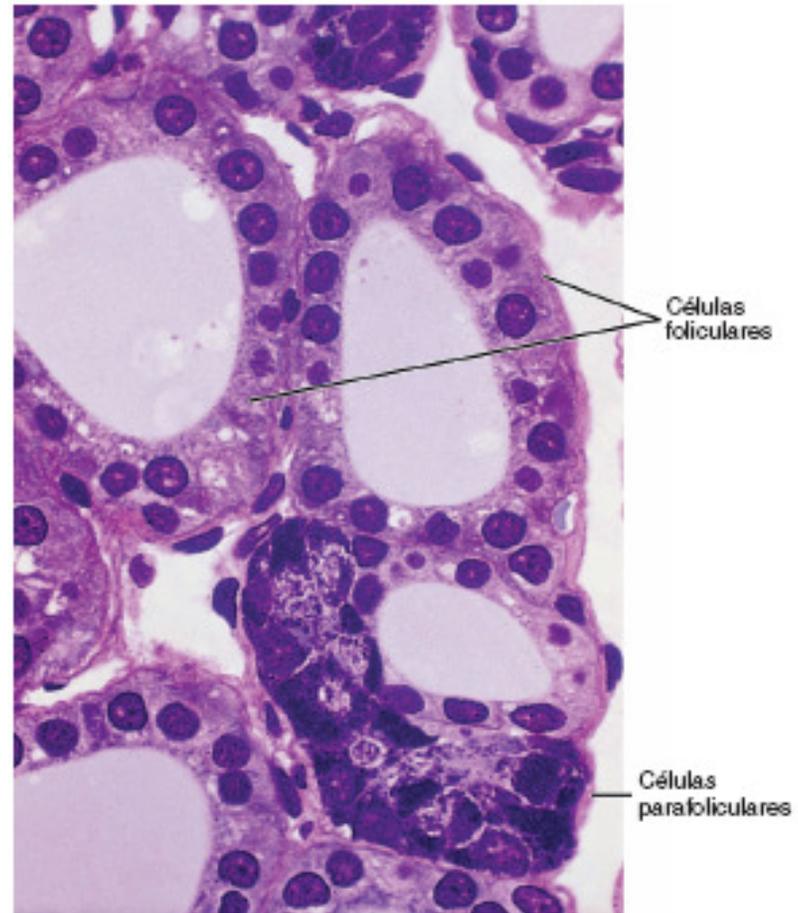
Tireóide : Glândula Endócrina Folicular

Folículos tireoidianos – Células Foliculares

Colóide - tireoglobulina (glicoproteína)



Sistema Endócrino - Tireóide



Sistema Endócrino - Tireóide

Secreção dos hormônios tireoidianos – T3 e T4

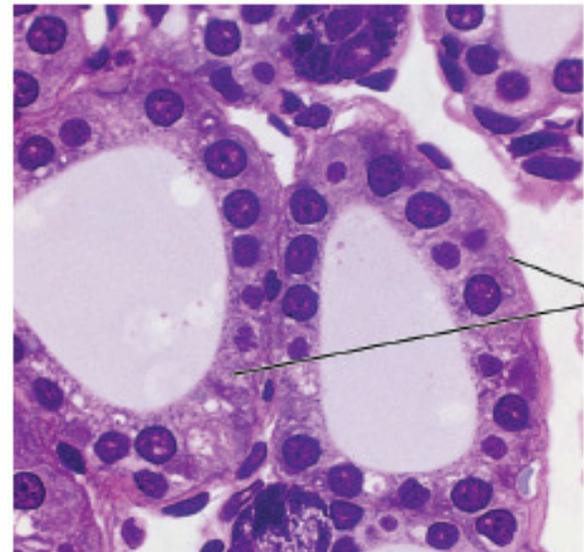
- A) Síntese da tireoglobulina.
- B) Seqüestro e transporte de iodeto.
- C) Ativação do Iodeto em iodo (enzima tireoperoxidase).
- D) Iodação dos radicais tirosina da tireoglobulina.
- E) Endocitose de partes do colóide
- F) Fusão das vesículas com lisossomos e formação de T3 e T4, MIT, DIT.

MIT – Monoiodotirosina

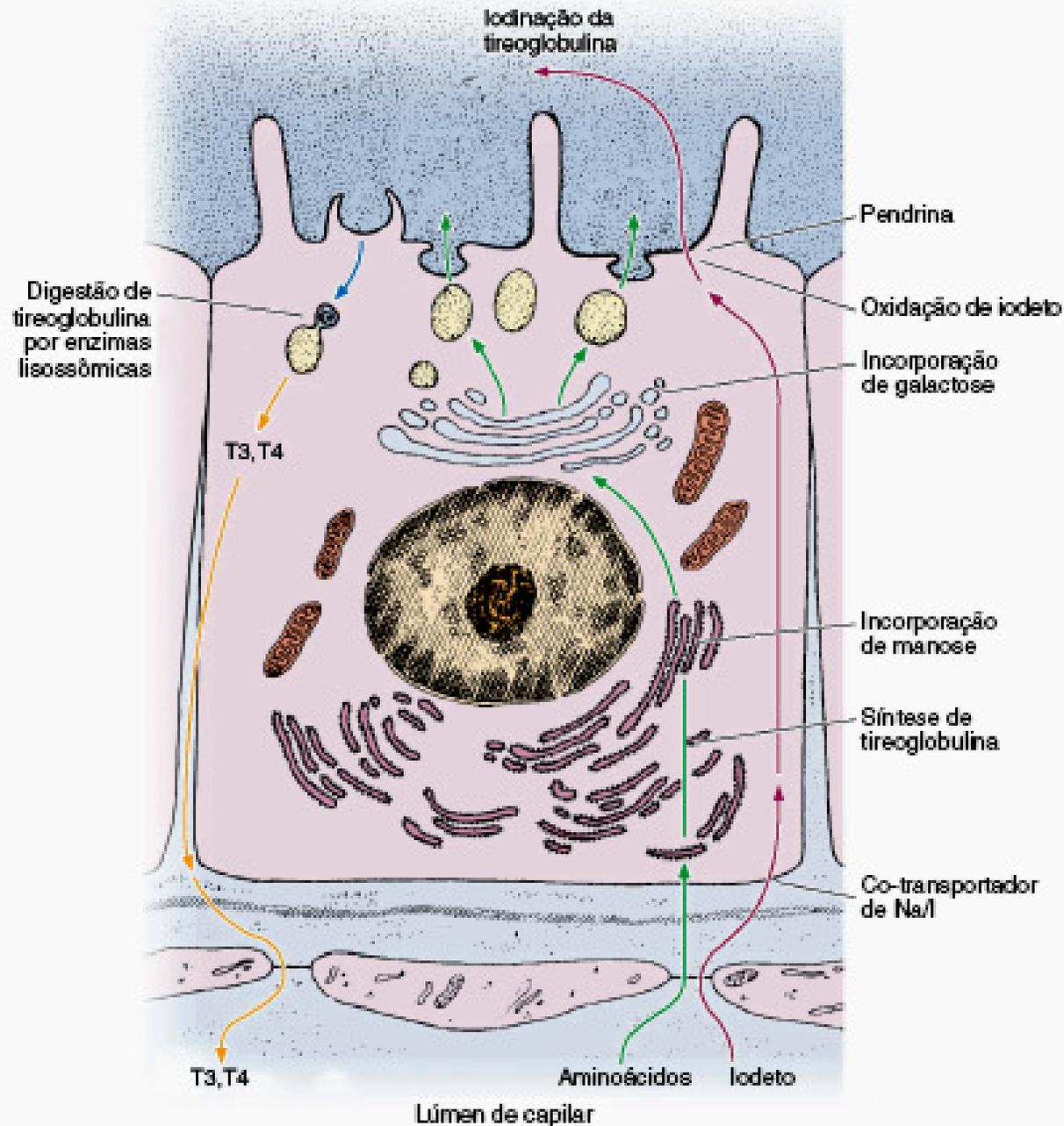
DIT – Diiodotirosina

T3 – Triiodotirosina

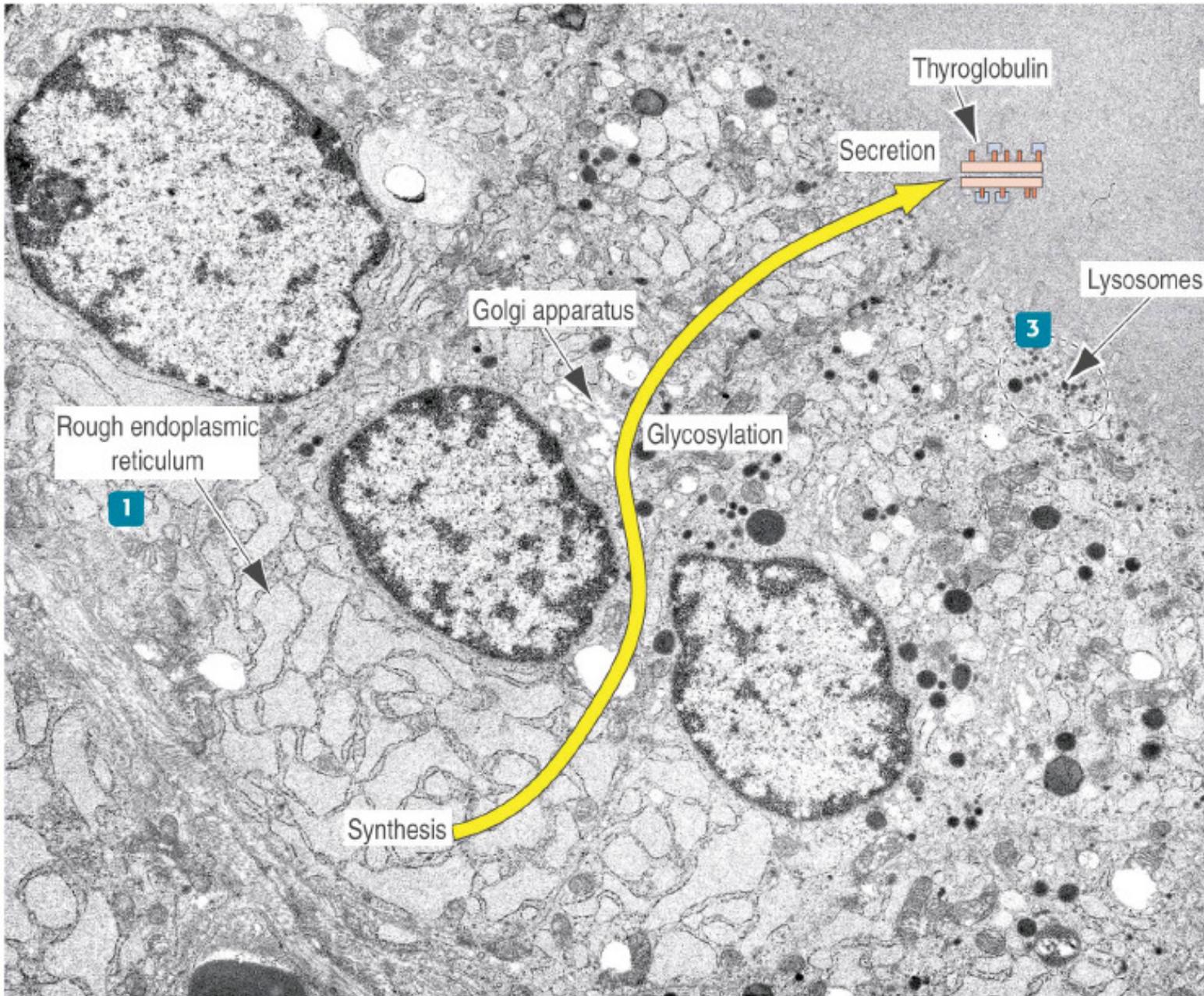
T4 - Tetraiodotirosina



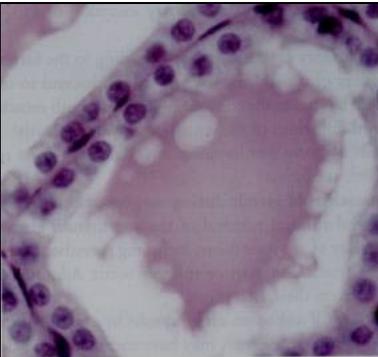
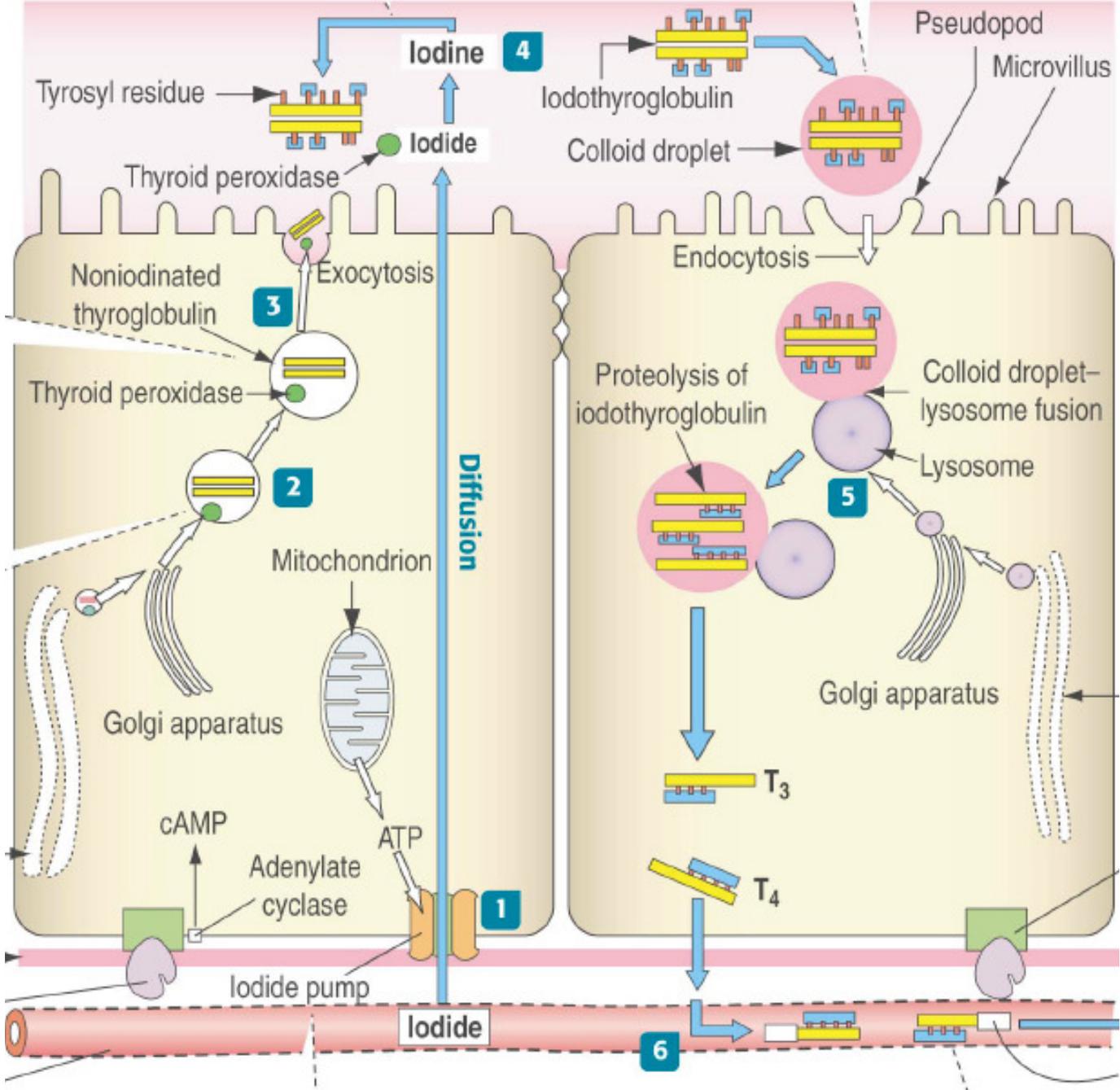
Sistema Endócrino - Tireóide



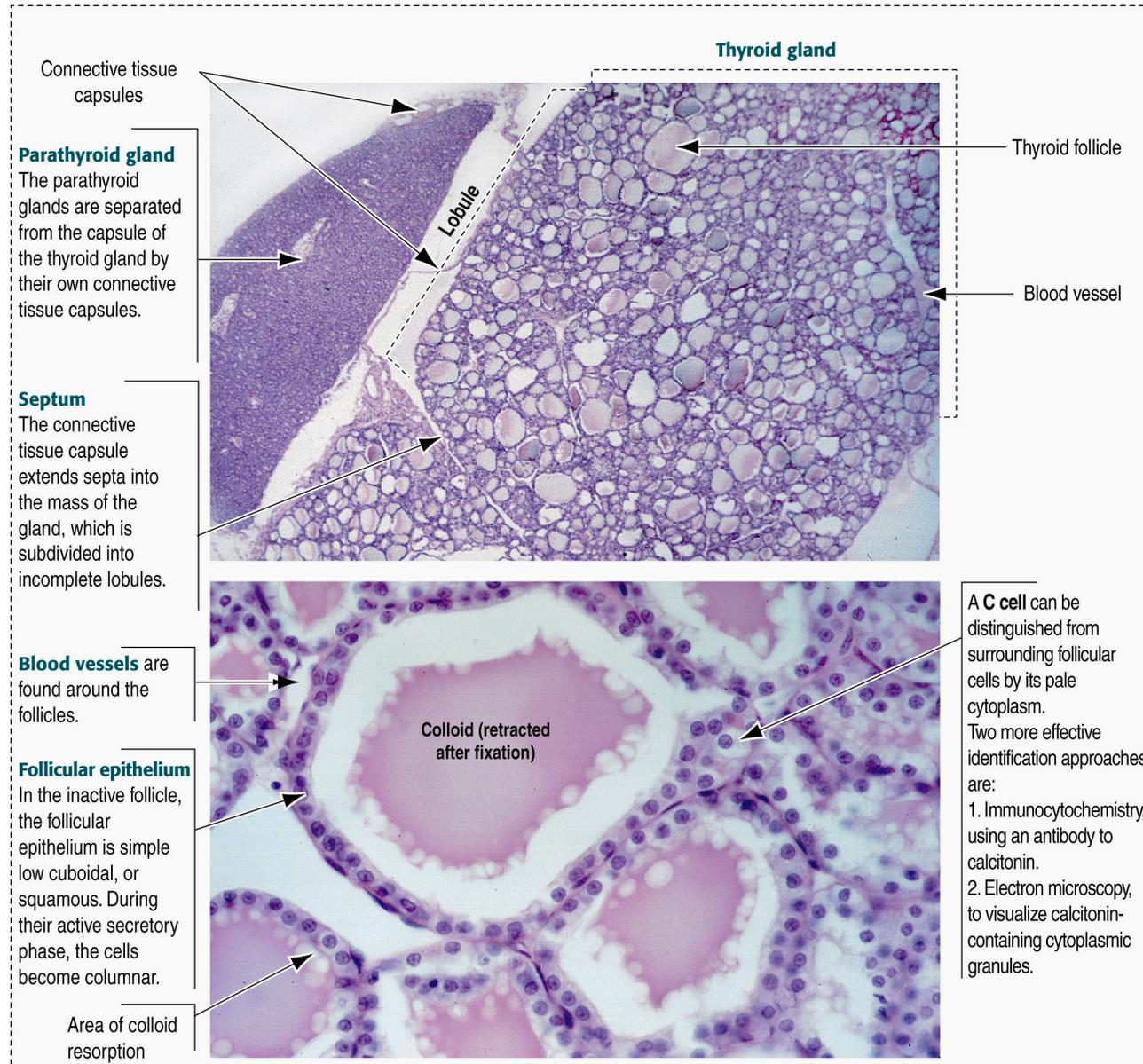
Sistema Endócrino - Tireóide



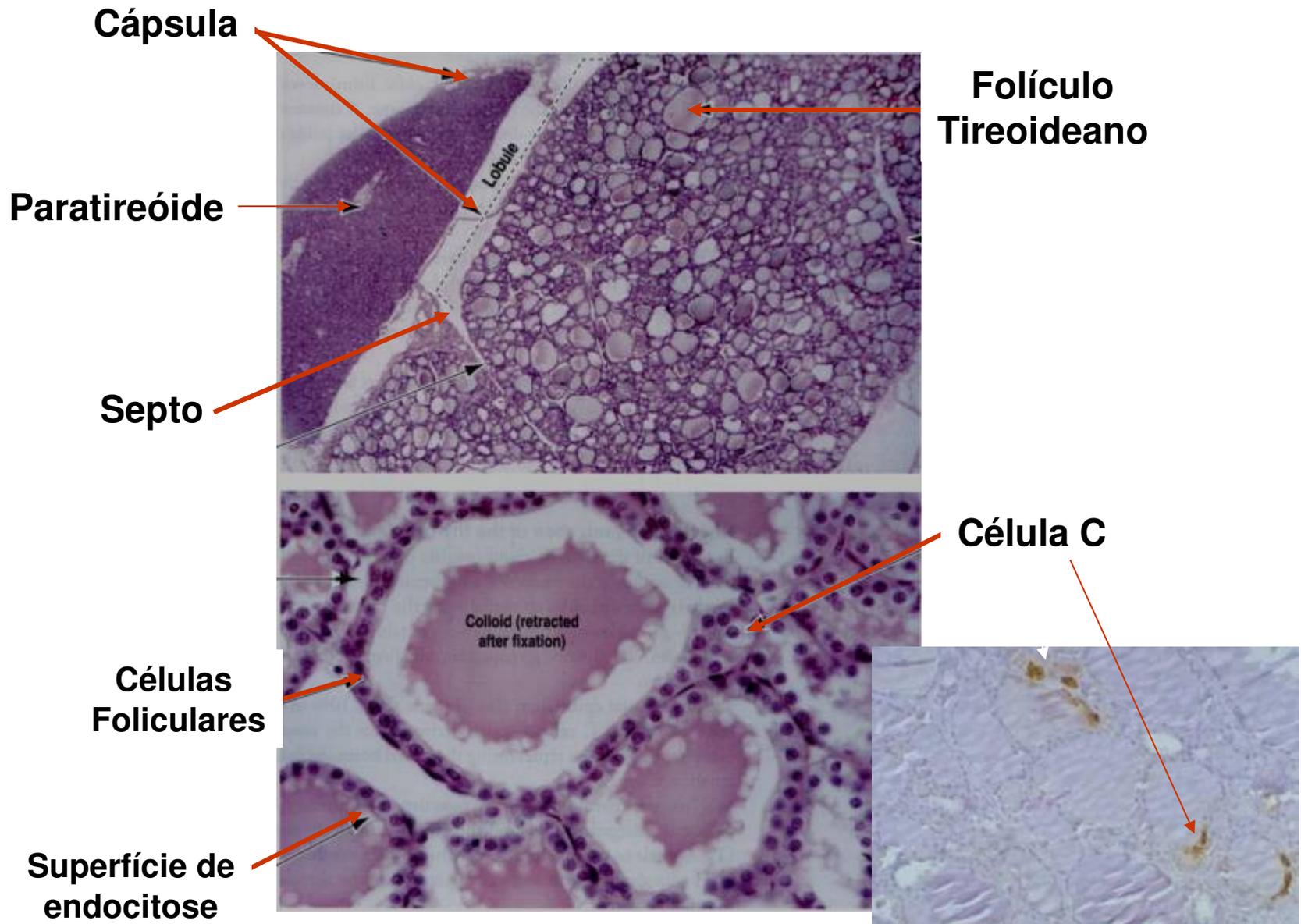
Tireóide



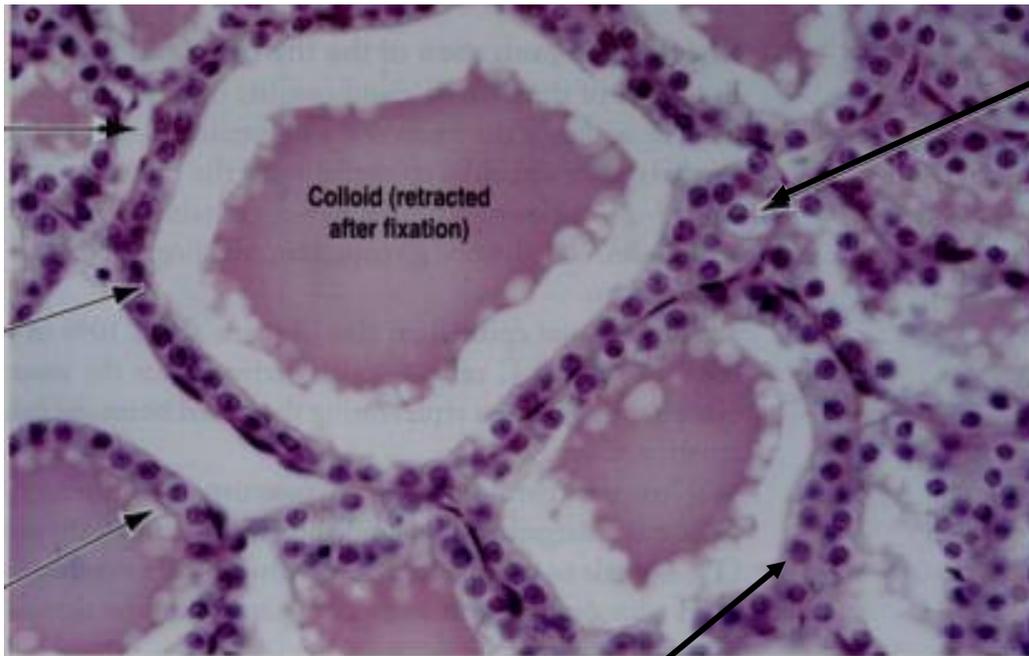
Sistema Endócrino - Tireóide



Sistema Endócrino - Tireóide

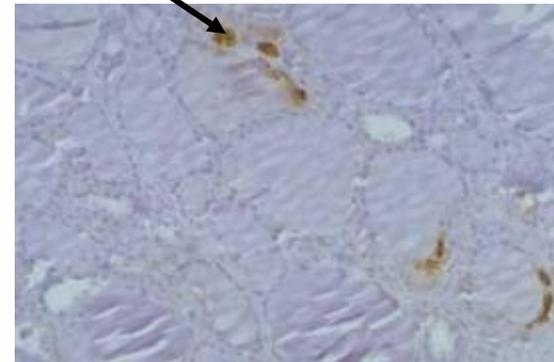


Sistema Endócrino - Tireóide



**Células
Foliculares**

Célula C (Parafoliculares)

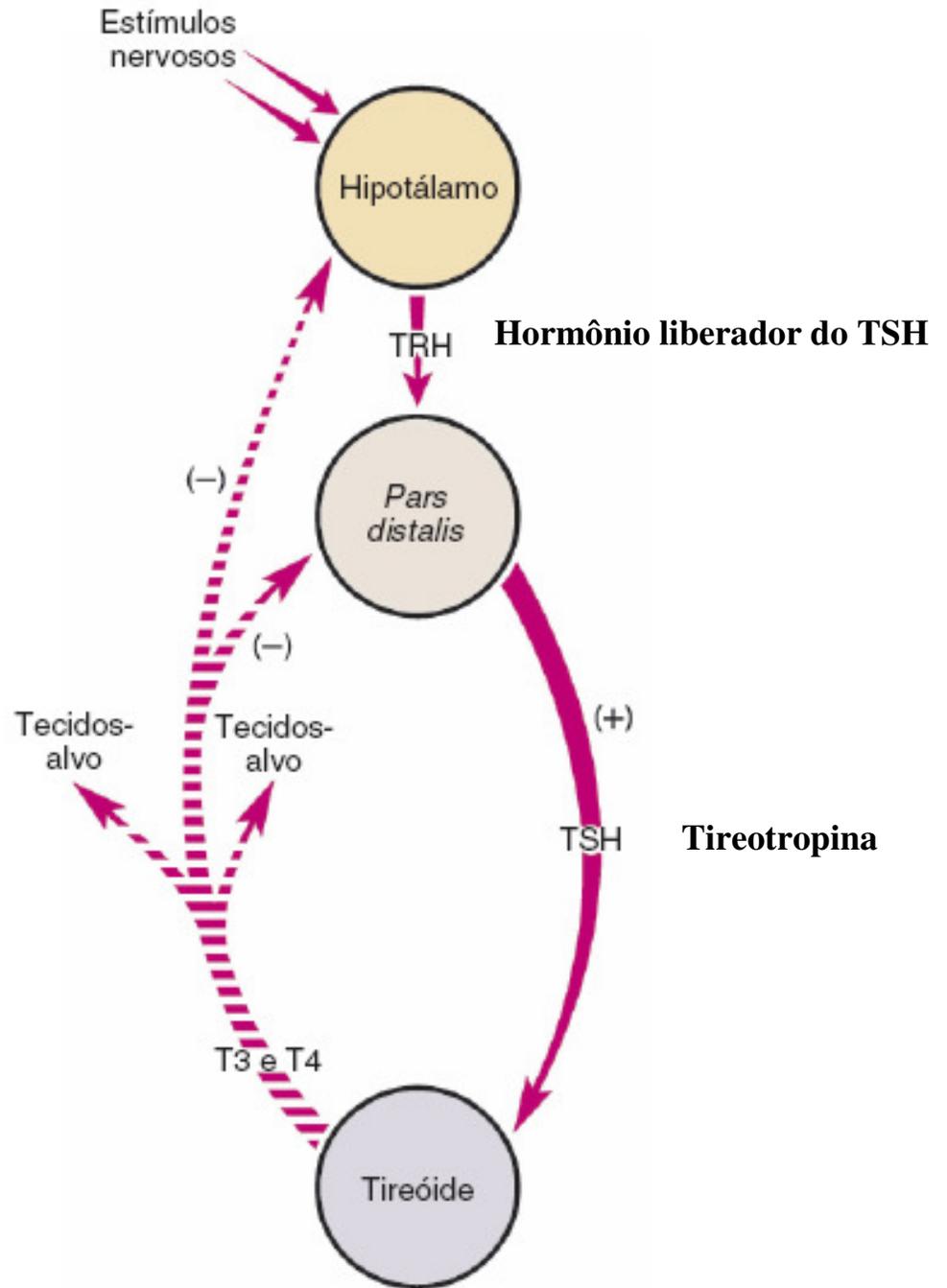


↓
**Secreção de
calcitonina**

↓
Inibe a reabsorção óssea
Diminui Cálcio no sangue

Sistema Endócrino Tireóide

Controle hormonal



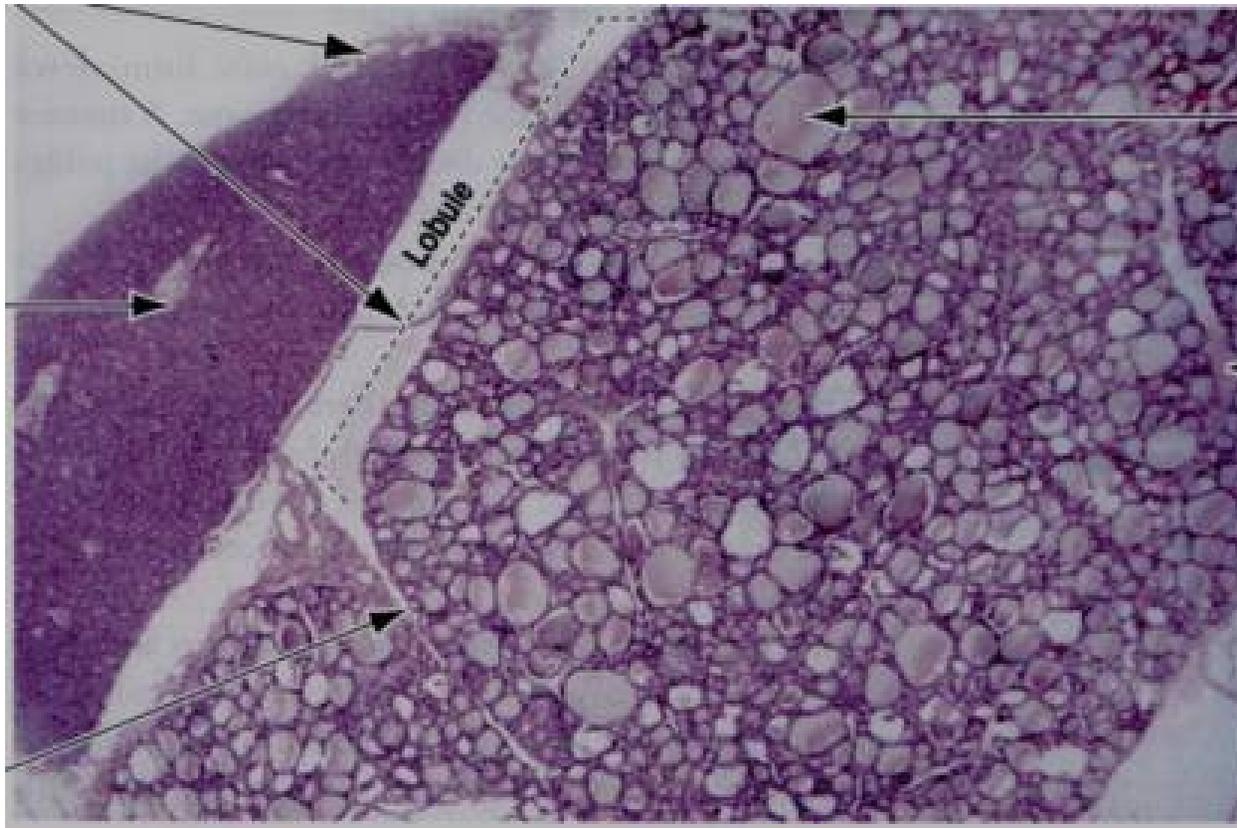
Sistema Endócrino: Paratireóide

Dois pares (superiores e inferiores)

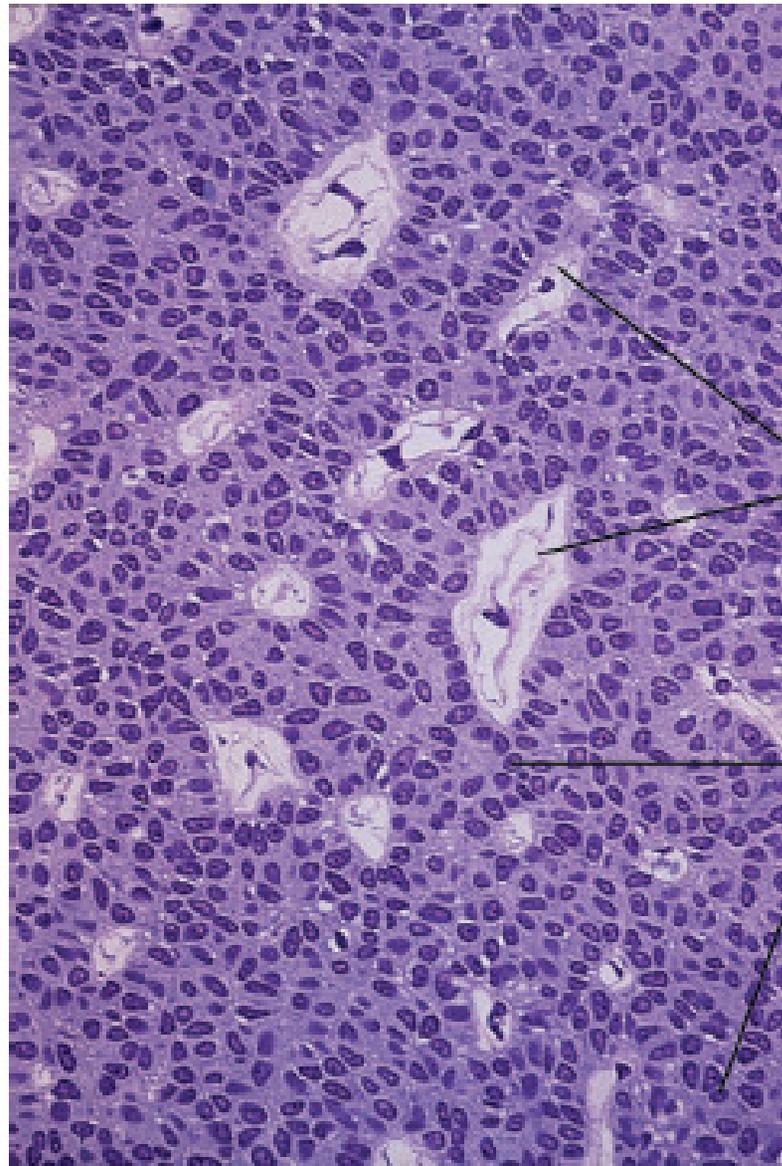
Fina cápsula de TCD e trabéculas

Tipos celulares – células principais (PTH) e células oxífilas ?

- Células principais - PTH (paratormônio) - mobilizam o Ca^{+2} do OSO



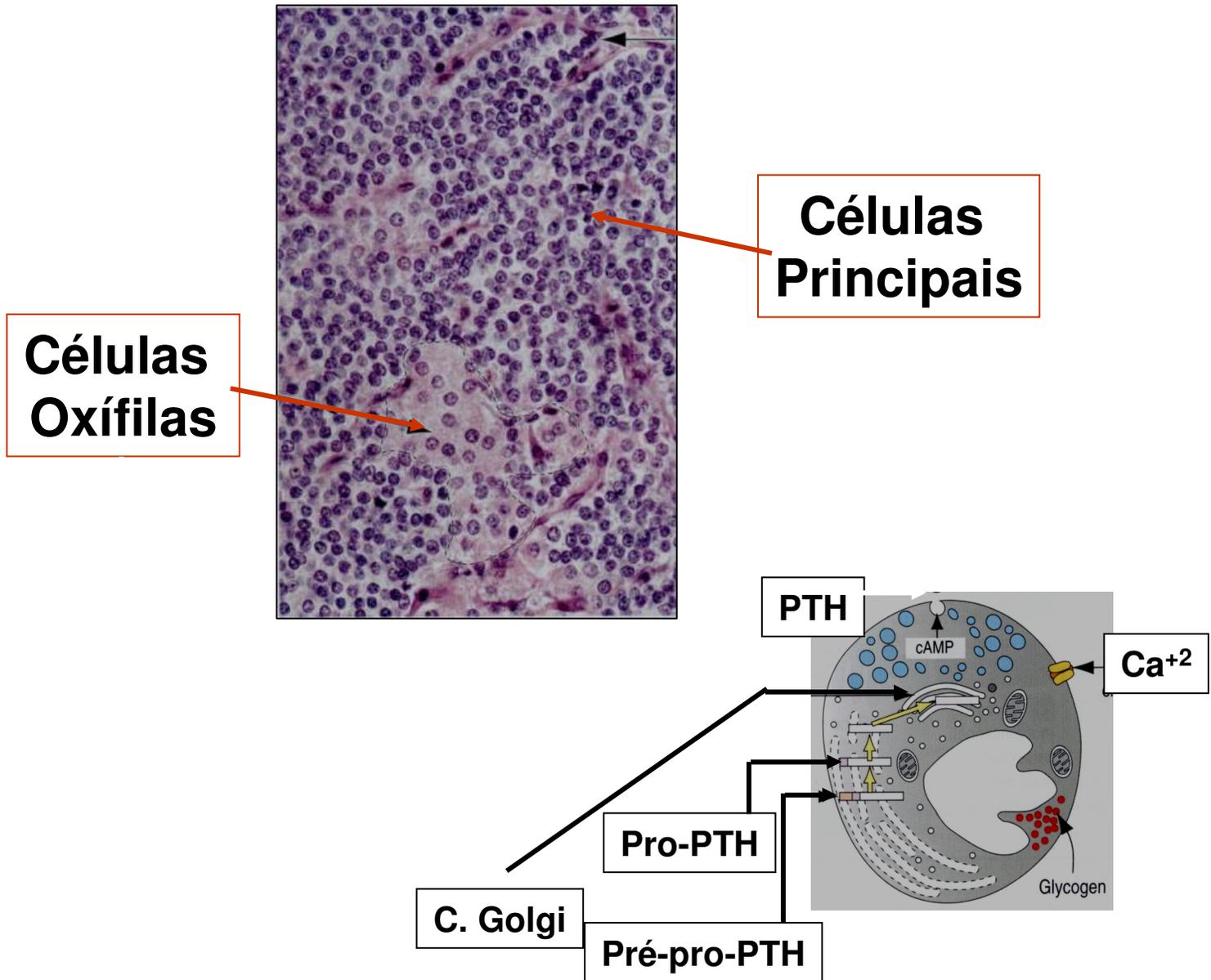
Sistema Endócrino: Paratireóide



Capilares
sanguíneos

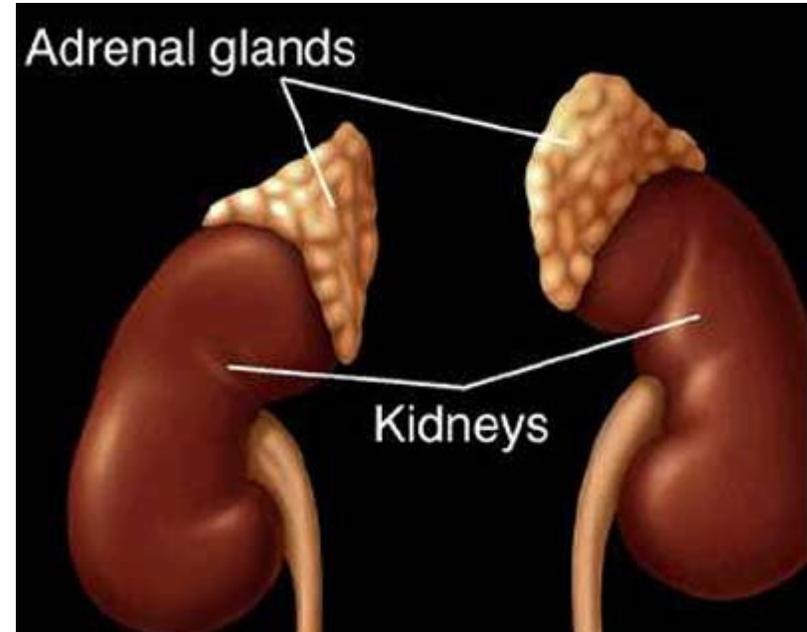
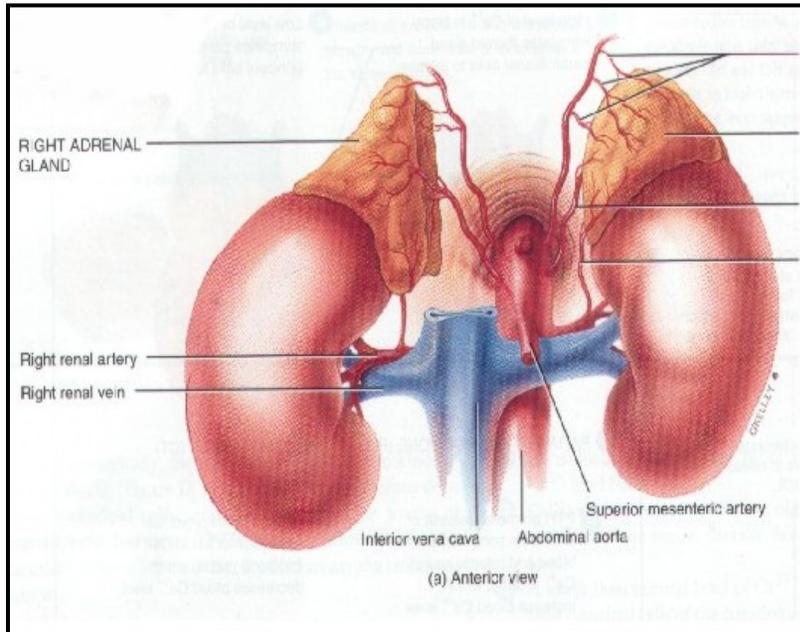
Cordões
celulares

Sistema Endócrino: Paratireóide



Sistema Endócrino - Adrenal

Pares e sobre o pólo superior dos rins
(tec.adiposo peri-renal)



Sistema Endócrino - Adrenal

Fina cápsula de TCD e trabéculas

Córtex (mesoderma)

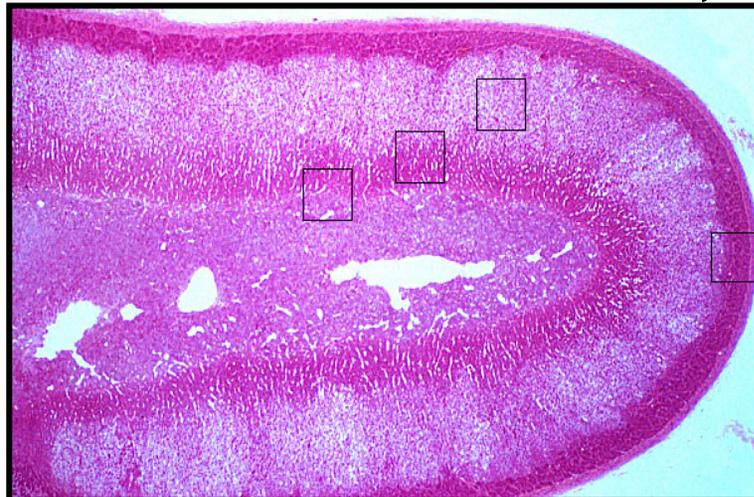
Zona glomerulosa – mineralocorticóides (aldosterona)

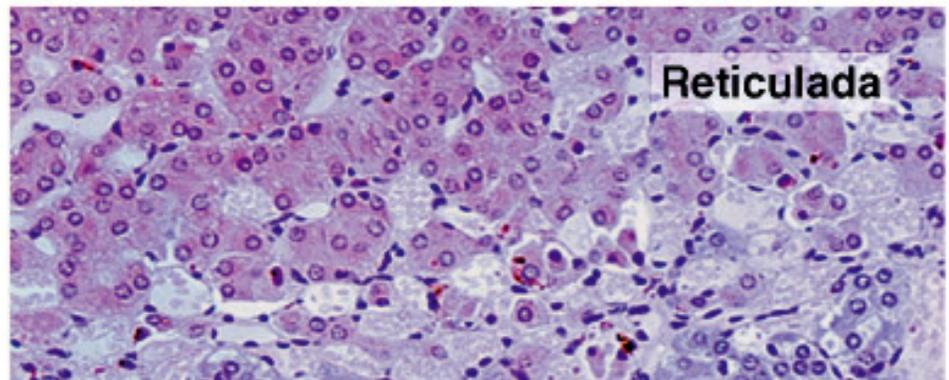
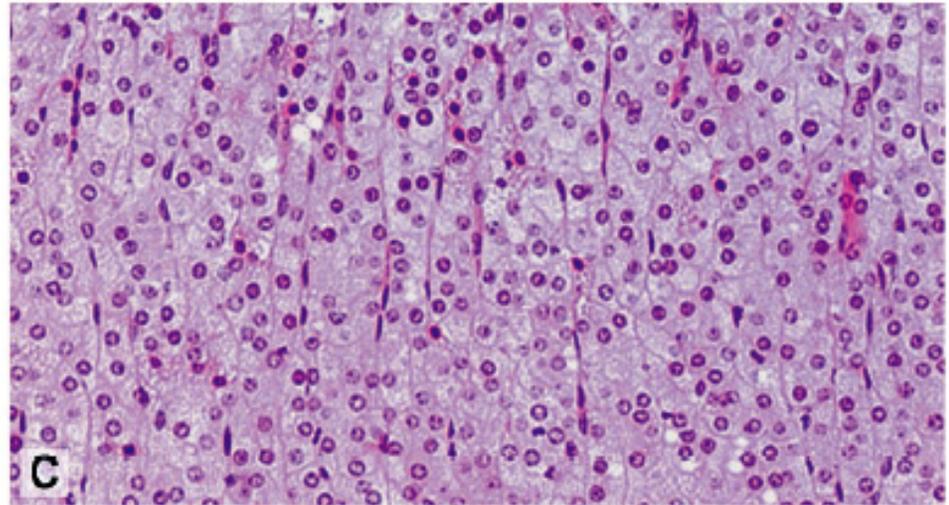
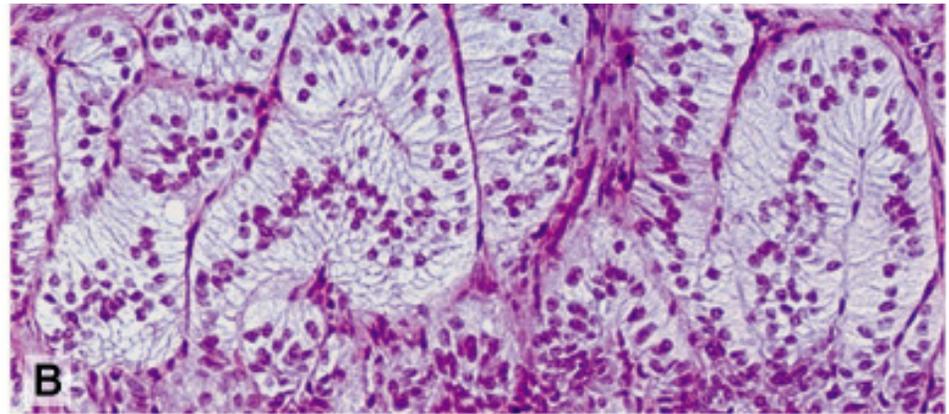
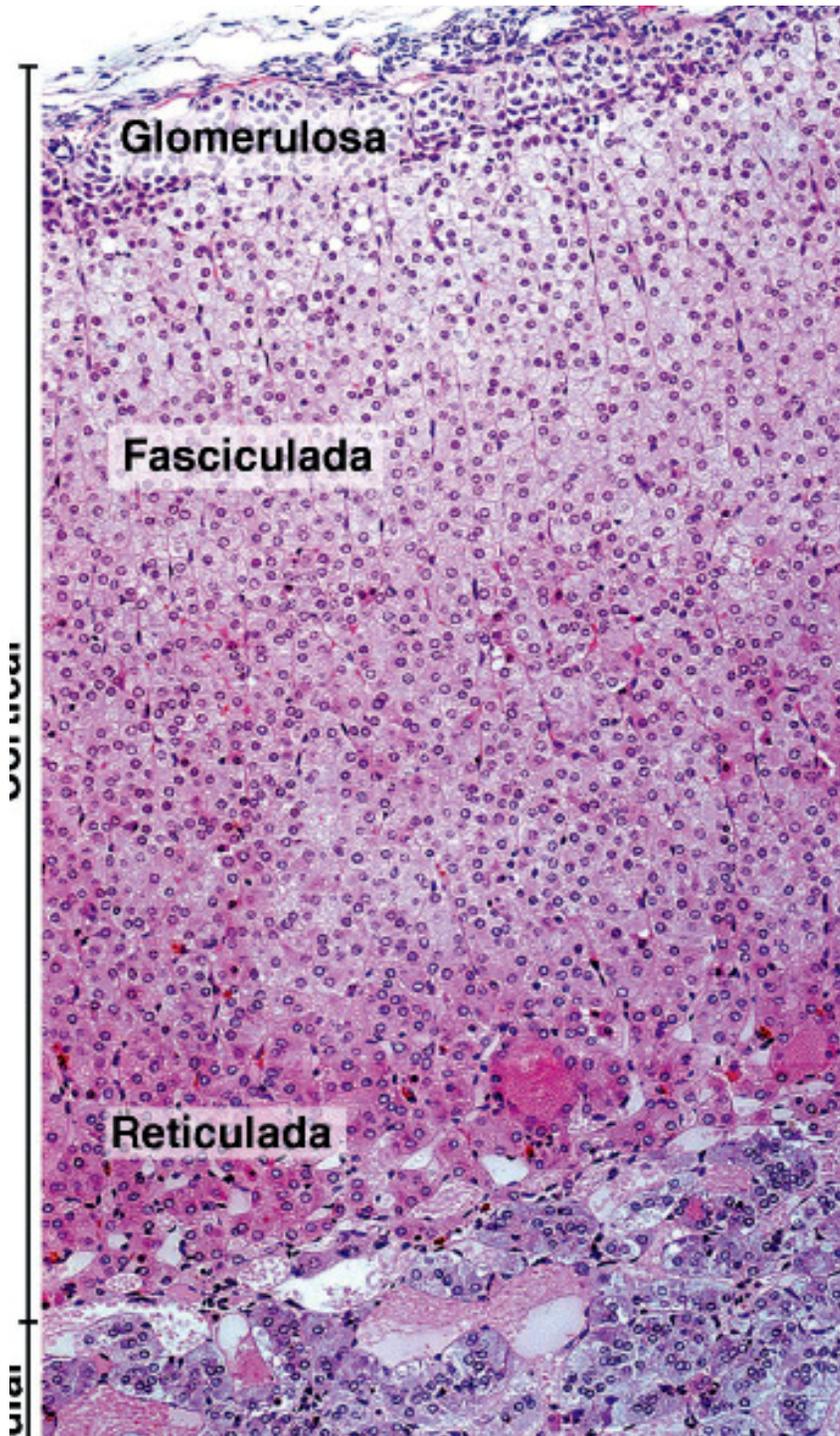
Zona fasciculada - glicocorticóides e andrógenos (ACTH)

Zona reticulada – andrógenos

Medula (crista neural)

células cromofins-catecolaminas: adrenalina, noradrenalina,





Sistema Endócrino

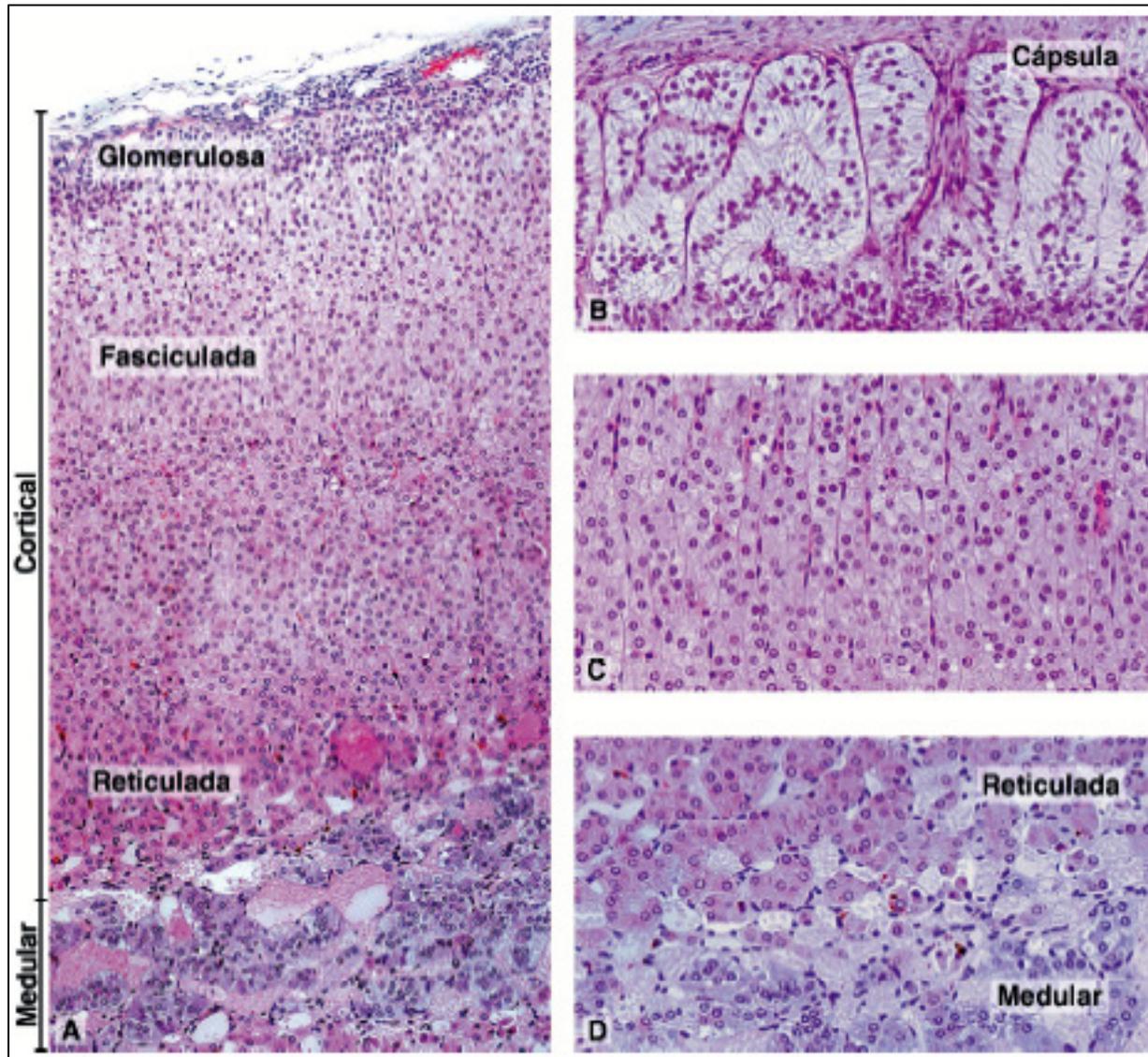
CÓRTEX

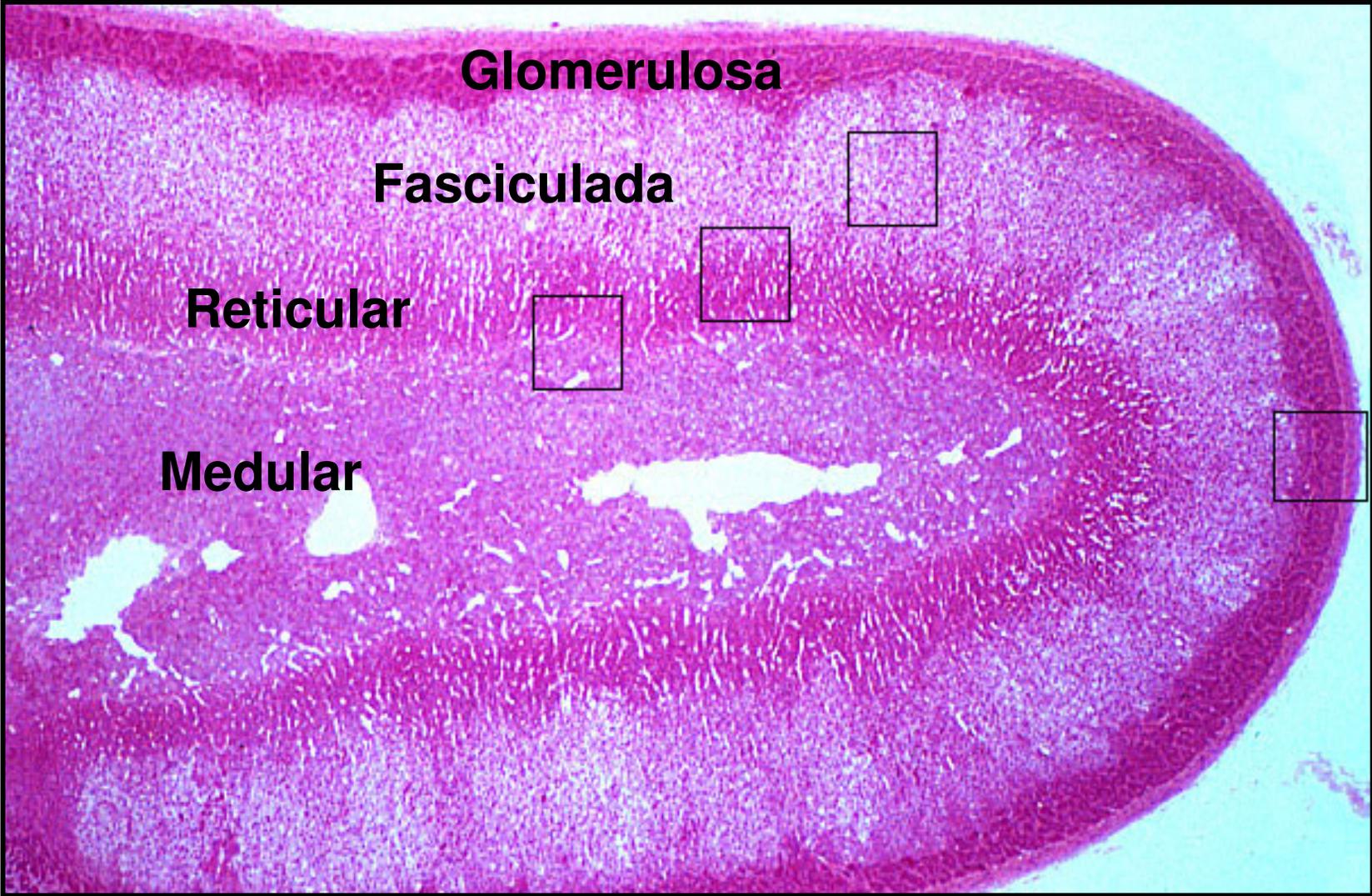
Zona glomerulosa – células colunares ou piramidais organizadas em cordões -arcos

Zona fasciculada – células poliédricas organizadas em cordões retos e regulares
espongiócitos

Zona reticulada – células organizadas em cordões irregulares

MEDULA



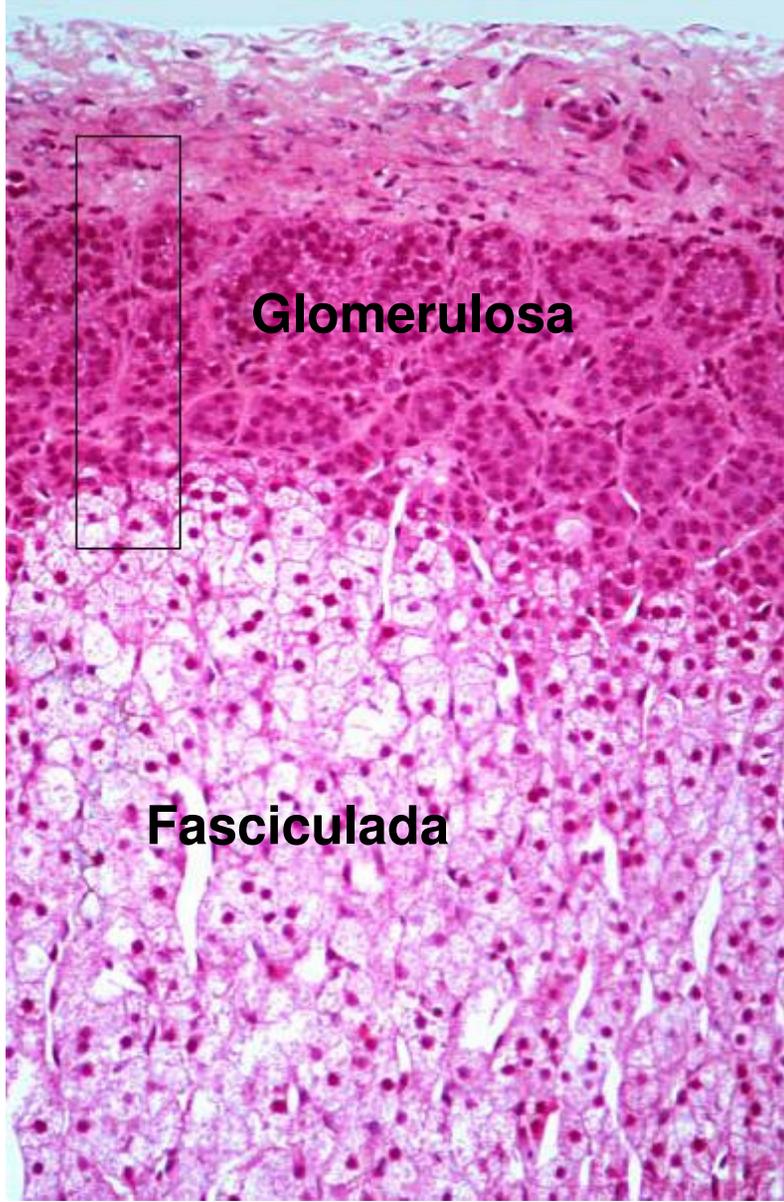


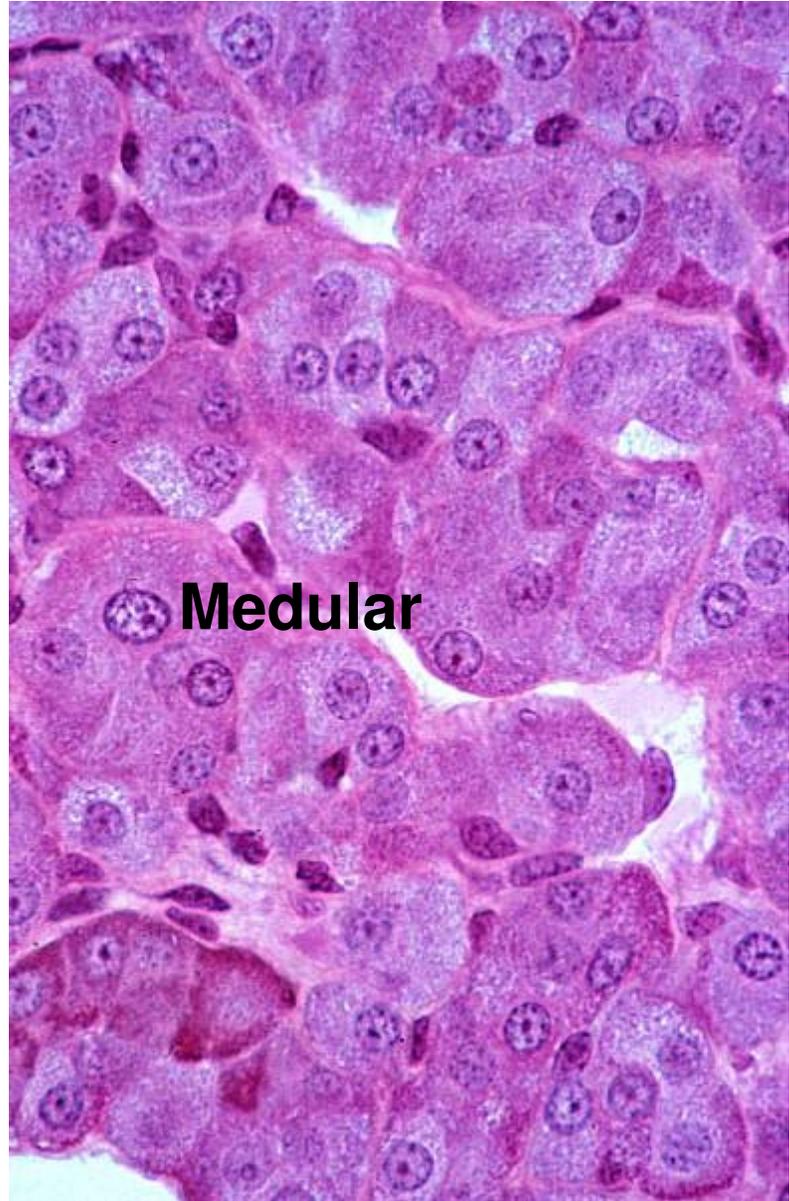
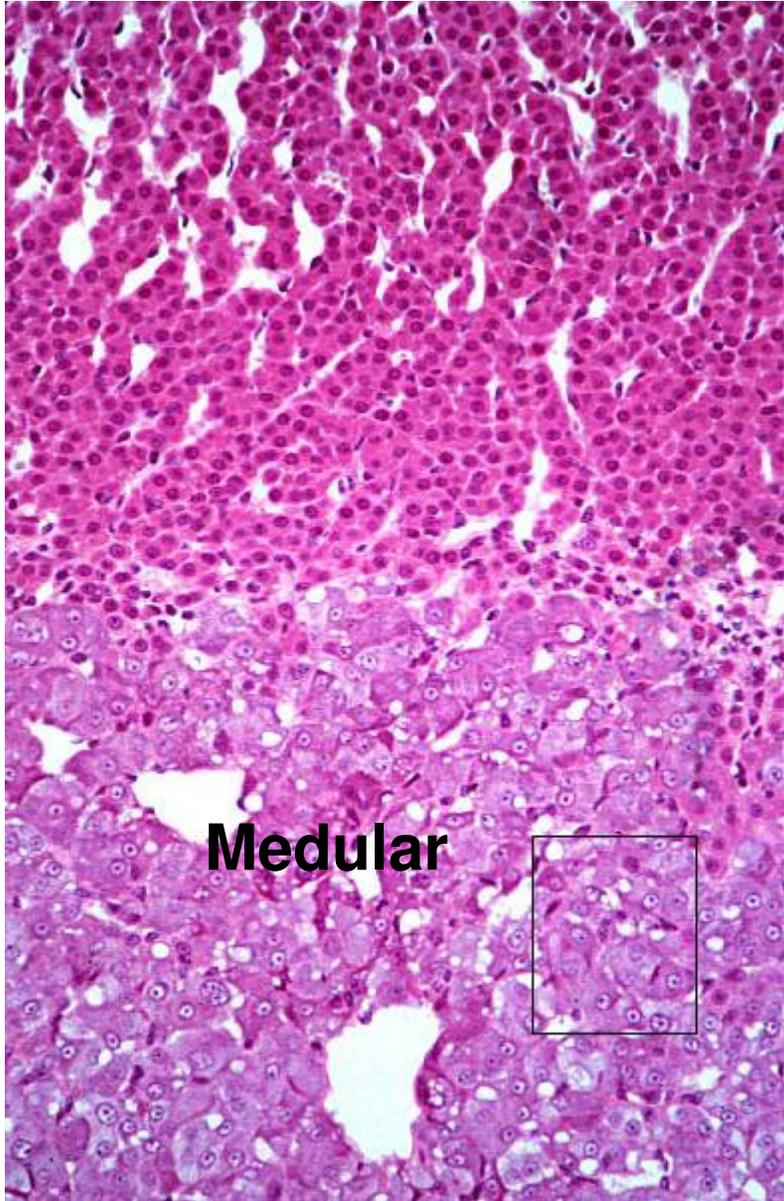
Glomerulosa

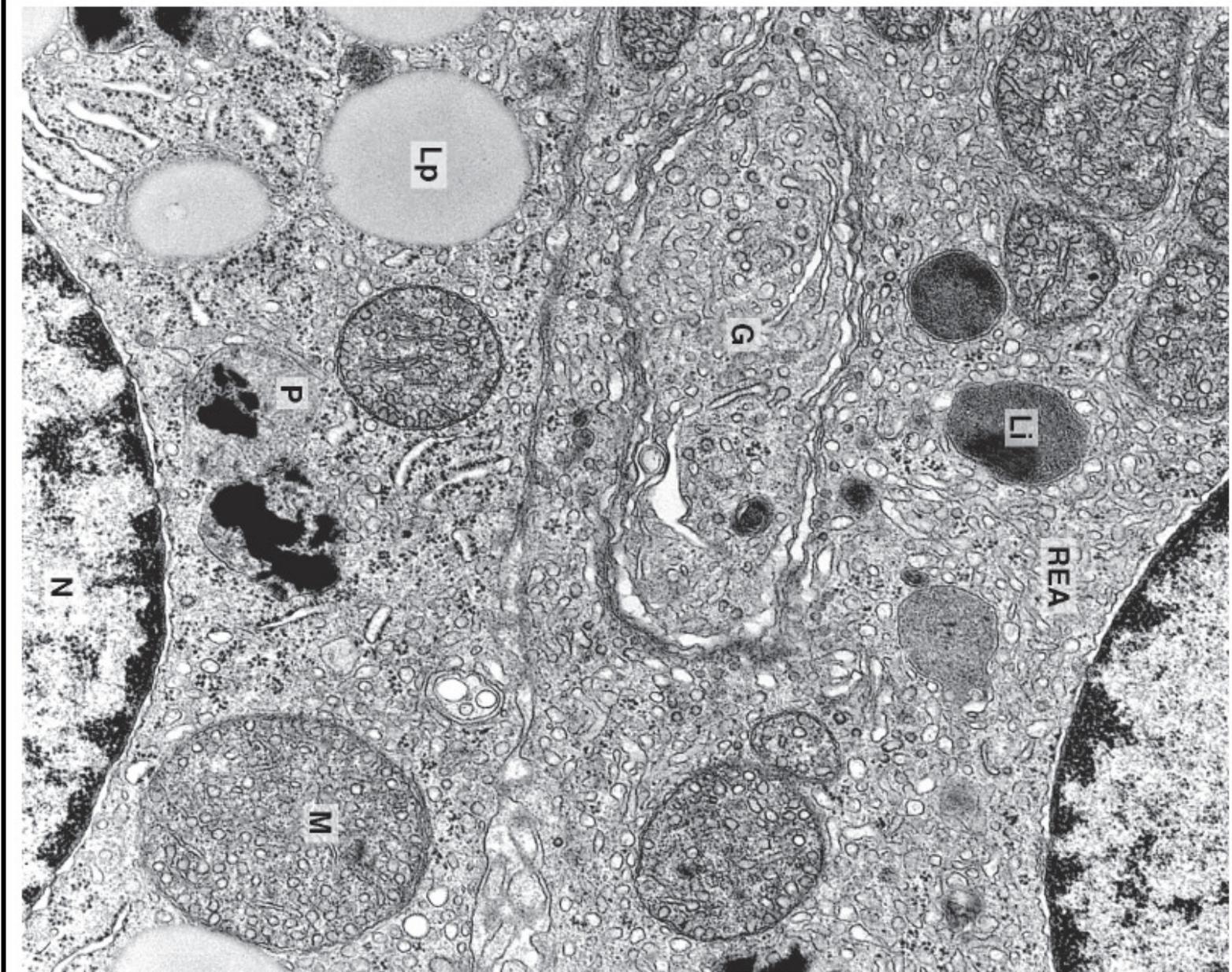
Fasciculata

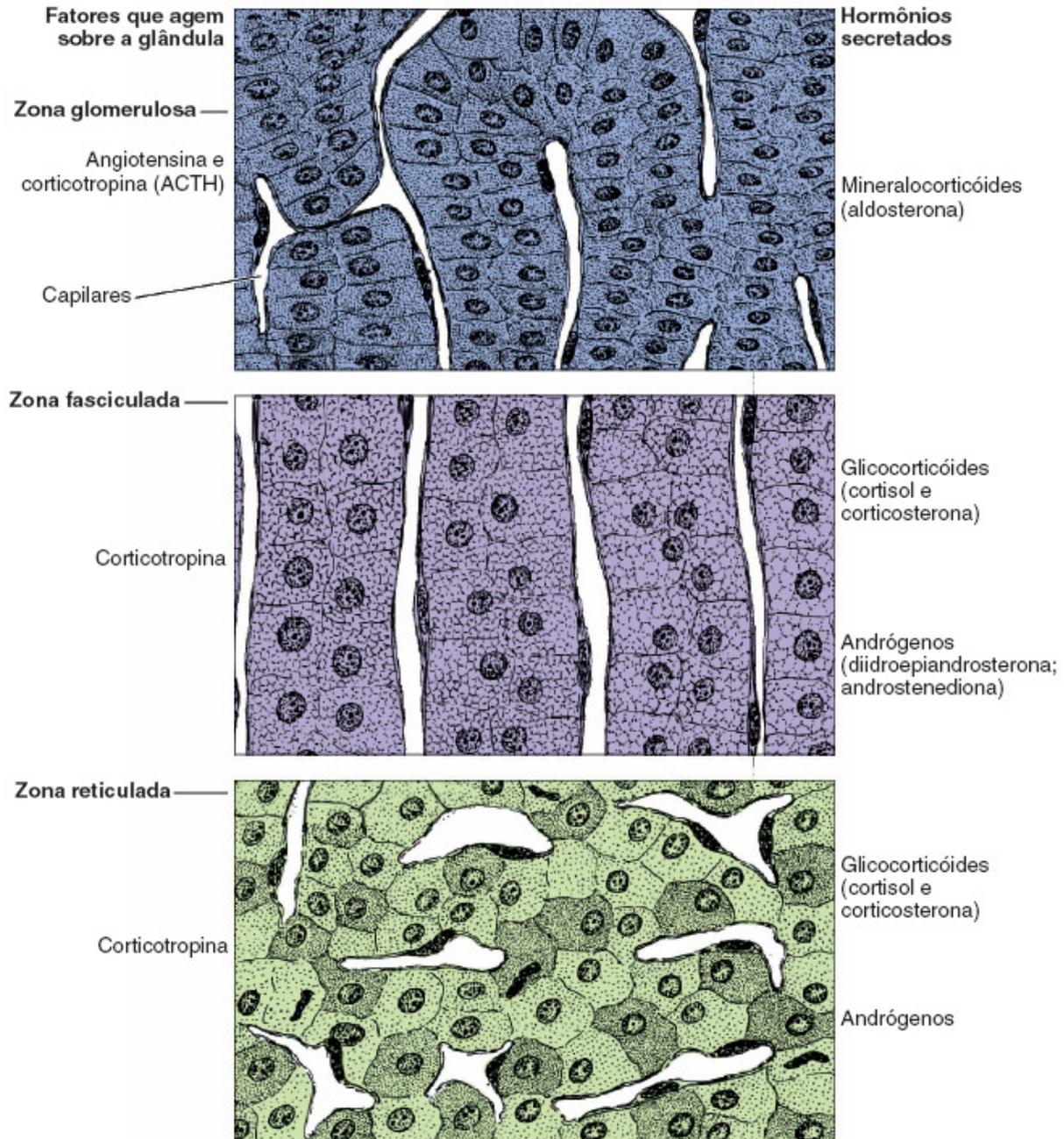
Reticular

Medular









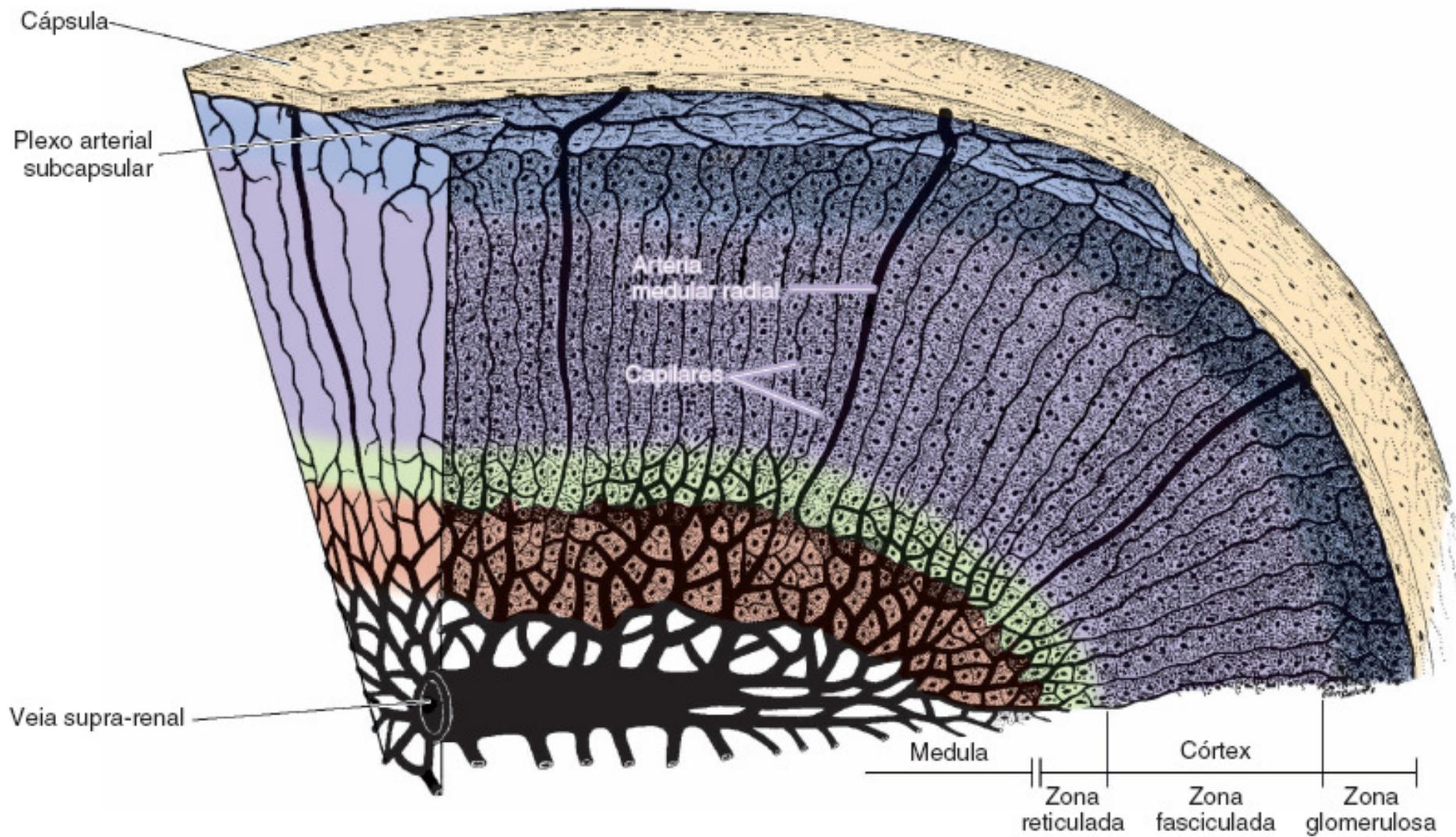
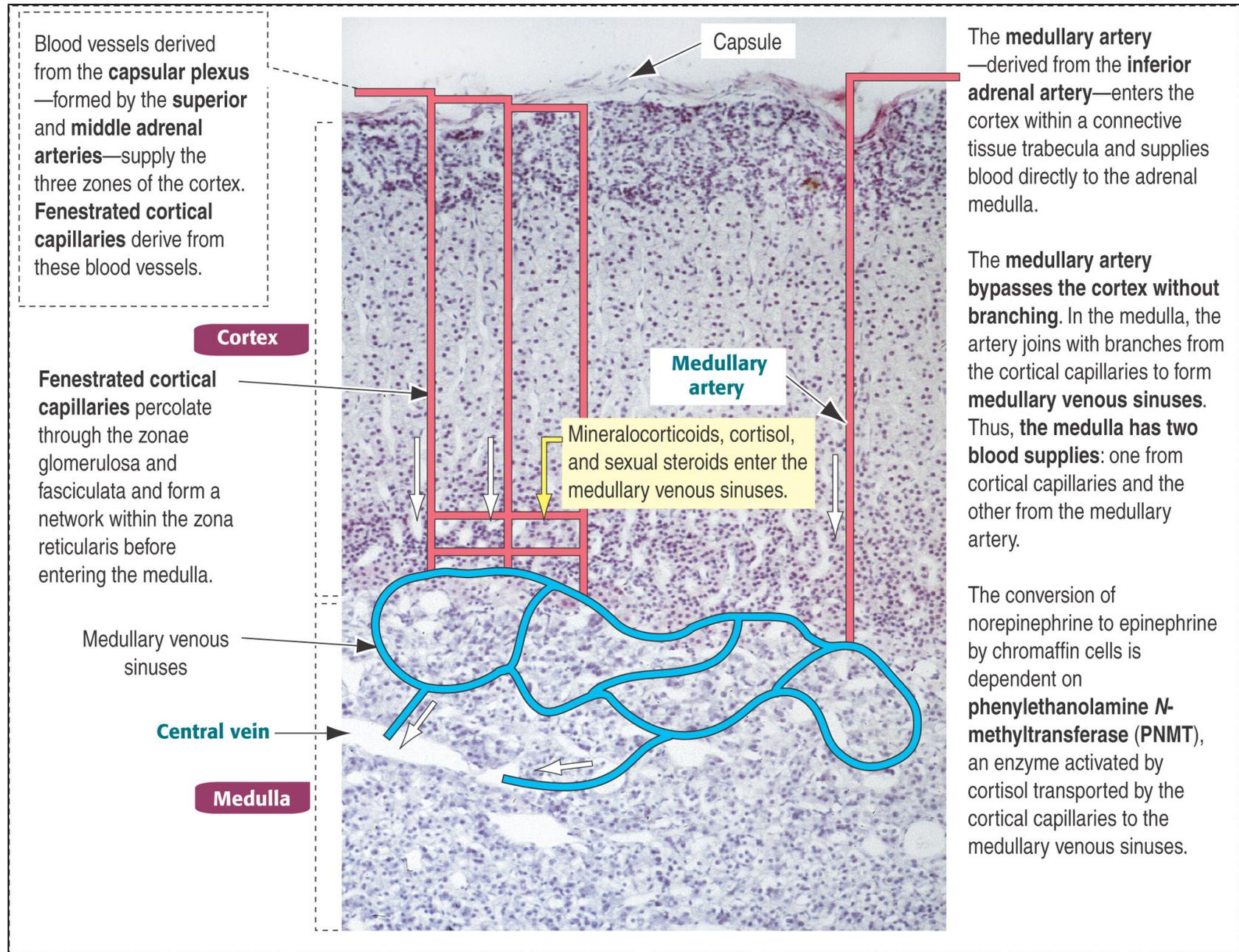


Fig. 20.11 Arquitetura geral e circulação de sangue na glândula adrenal.

Sistema Endócrino - Adrenal



Blood vessels derived from the **capsular plexus**—formed by the **superior and middle adrenal arteries**—supply the three zones of the cortex. **Fenestrated cortical capillaries** derive from these blood vessels.

Cortex

Fenestrated cortical capillaries percolate through the zonae glomerulosa and fasciculata and form a network within the zona reticularis before entering the medulla.

Medullary venous sinuses

Central vein

Medulla

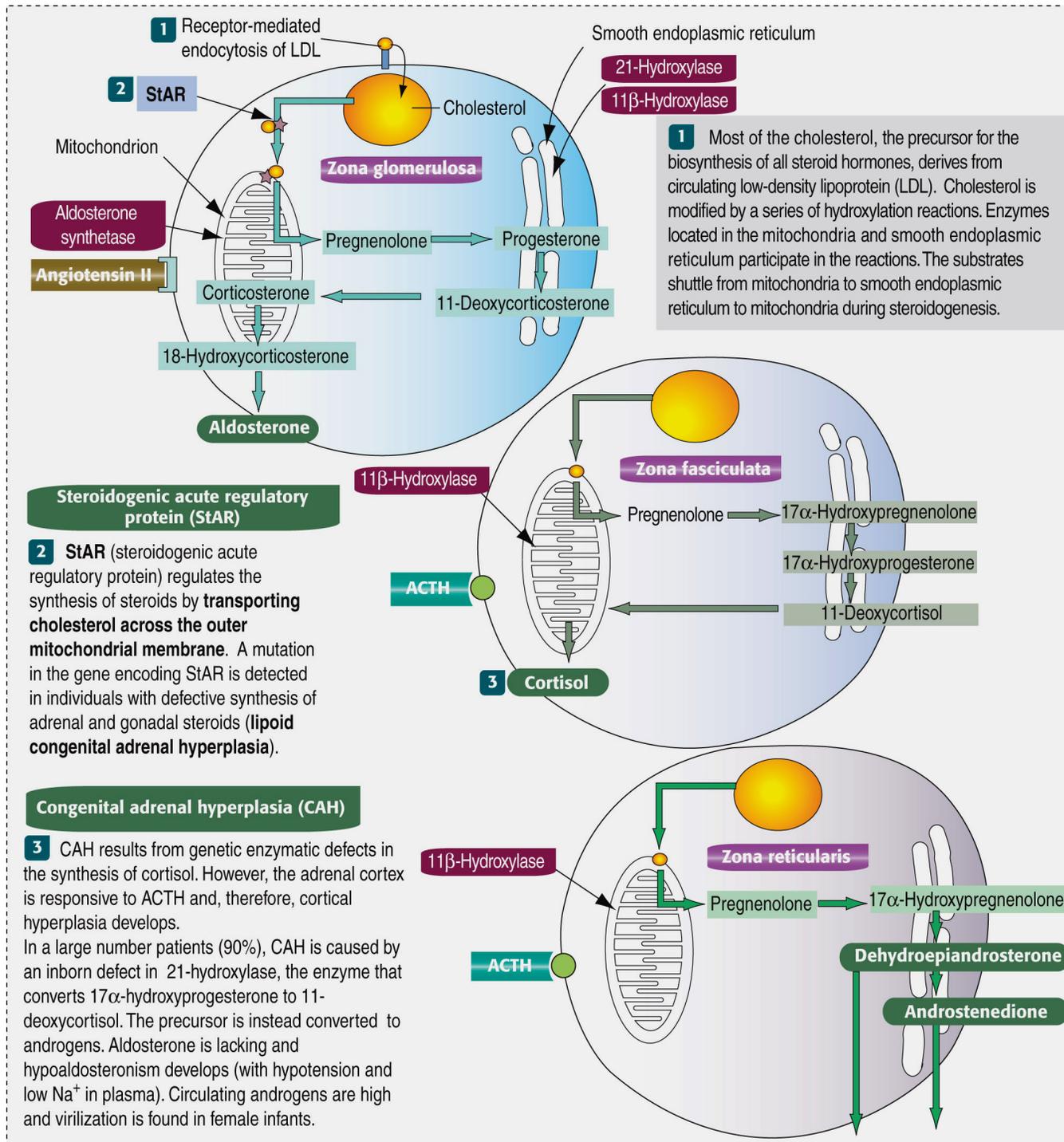
Medullary artery

Mineralocorticoids, cortisol, and sexual steroids enter the medullary venous sinuses.

The **medullary artery**—derived from the **inferior adrenal artery**—enters the cortex within a connective tissue trabecula and supplies blood directly to the adrenal medulla.

The **medullary artery bypasses the cortex without branching**. In the medulla, the artery joins with branches from the cortical capillaries to form **medullary venous sinuses**. Thus, **the medulla has two blood supplies**: one from cortical capillaries and the other from the medullary artery.

The conversion of norepinephrine to epinephrine by chromaffin cells is dependent on **phenylethanolamine N-methyltransferase (PNMT)**, an enzyme activated by cortisol transported by the cortical capillaries to the medullary venous sinuses.



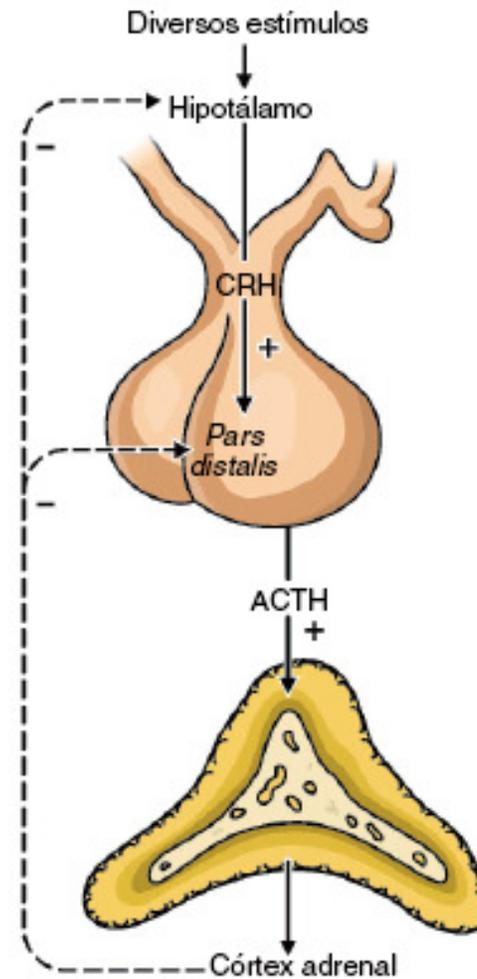


Fig. 20.15 Mecanismo de controle de secreção de ACTH e de glicocorticóides. CRH, hormônio libertador de corticotropina, ACTH, corticotropina.

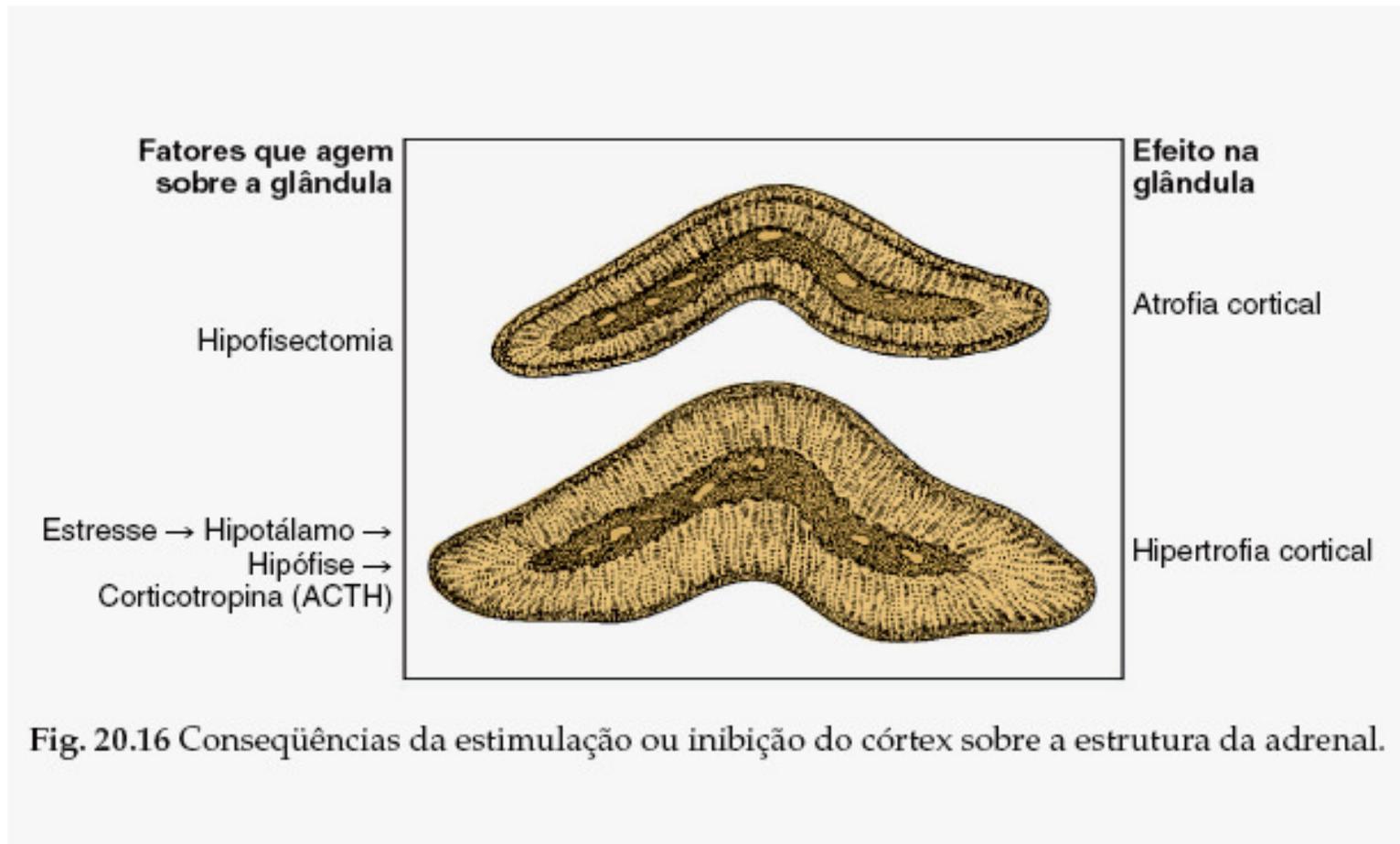
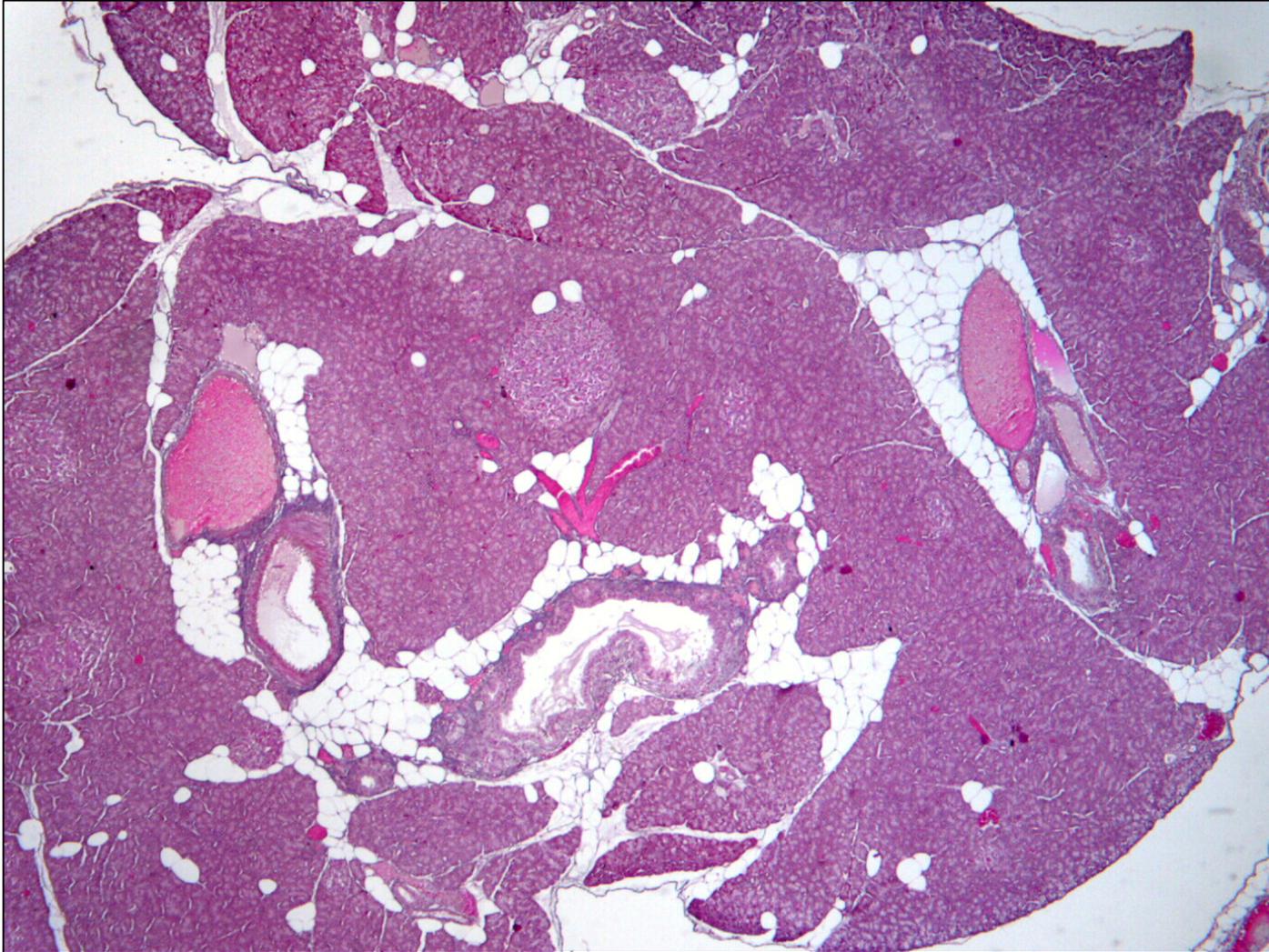
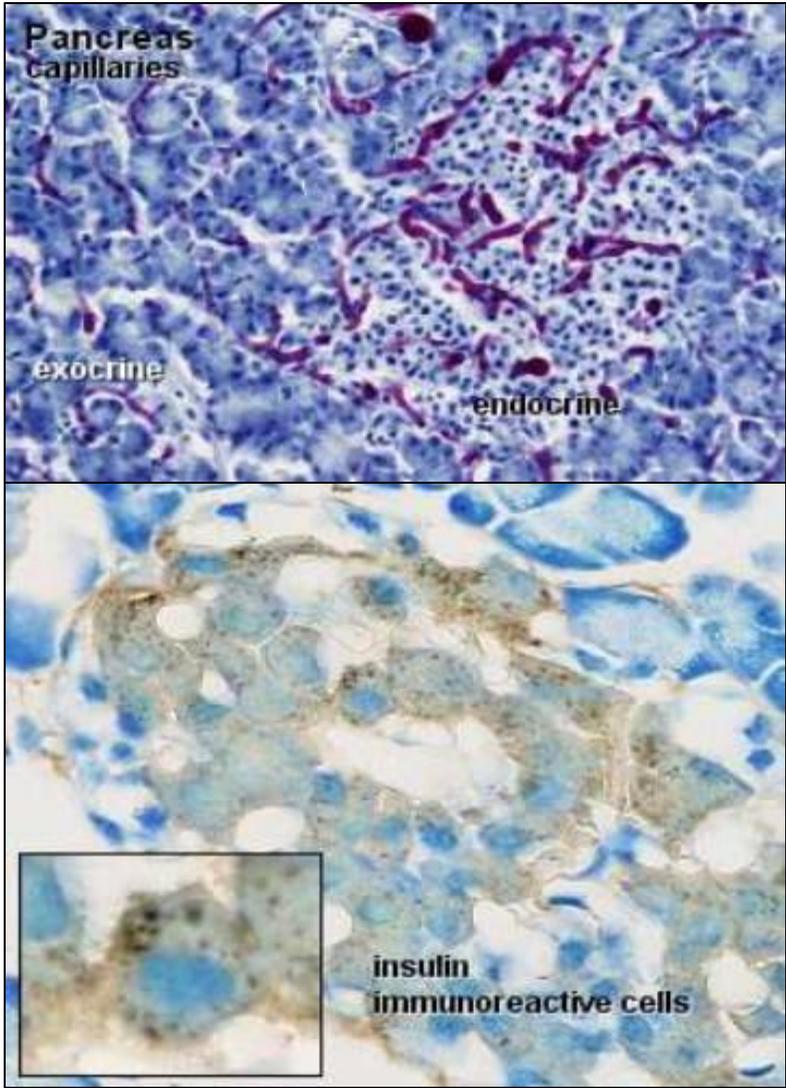
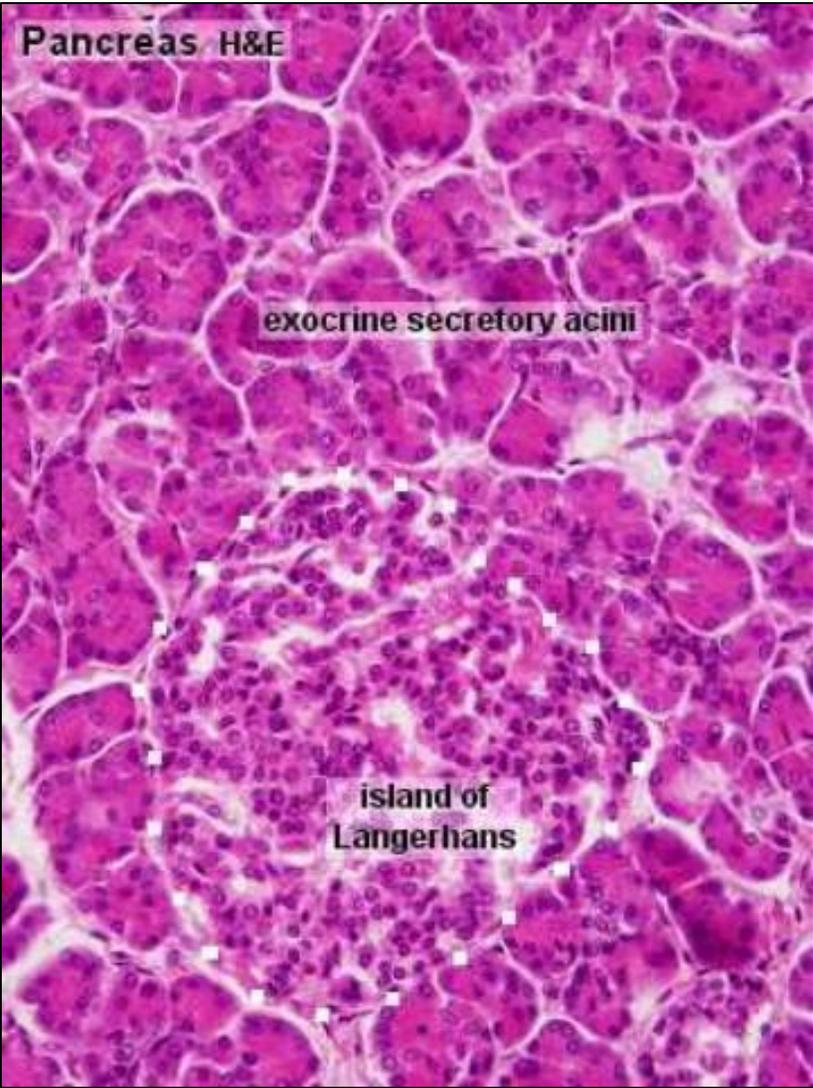


Fig. 20.16 Conseqüências da estimulação ou inibição do córtex sobre a estrutura da adrenal.

Pâncreas



Ilhotas de Langerhans

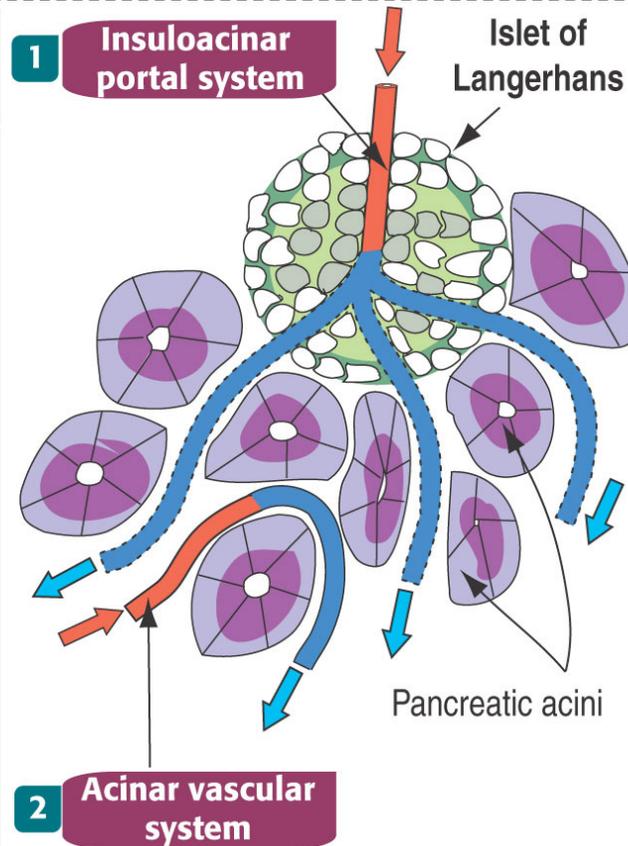


Dual blood supply: Acinar and insuloacinar vascular systems

1 Each islet of Langerhans is supplied by afferent arterioles, forming a network of capillaries lined by fenestrated endothelial cells. This network is called the **insuloacinar portal system**.

Capillaries leaving the islet supply blood to the pancreatic acini surrounding the islet. This vascular system enables a local action on the exocrine pancreas of hormones produced in the islet.

2 An independent arterial system, the **acinar vascular system**, supplies the pancreatic acini.



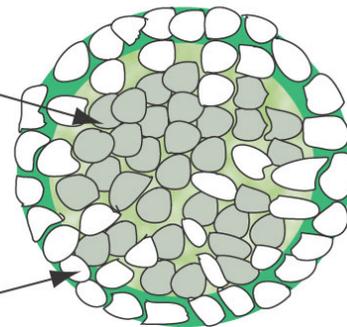
Topographic distribution of endocrine cells in the islets of Langerhans

Core

Beta cells predominate in the core.

Mantle

Other cells—alpha, delta, and F cells—are present in the mantle.



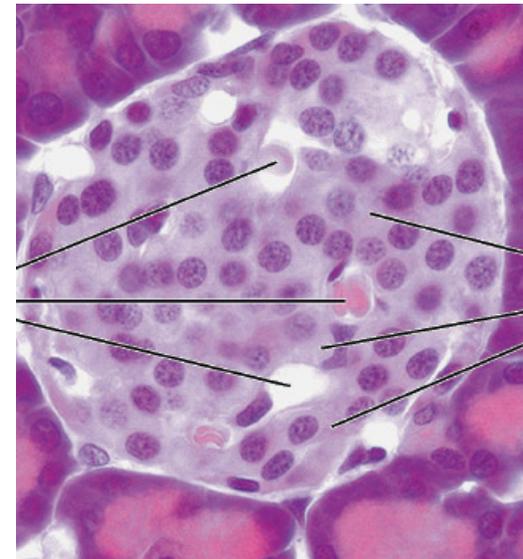
Sistema Endócrino

➤ Ilhotas pancreáticas (Langerhans)

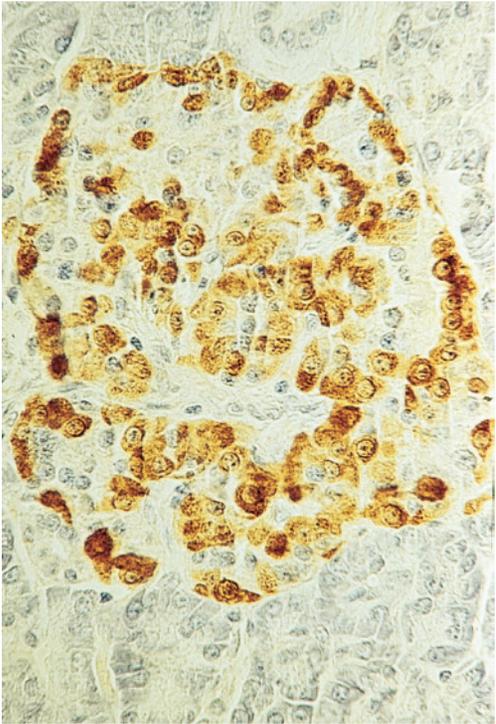
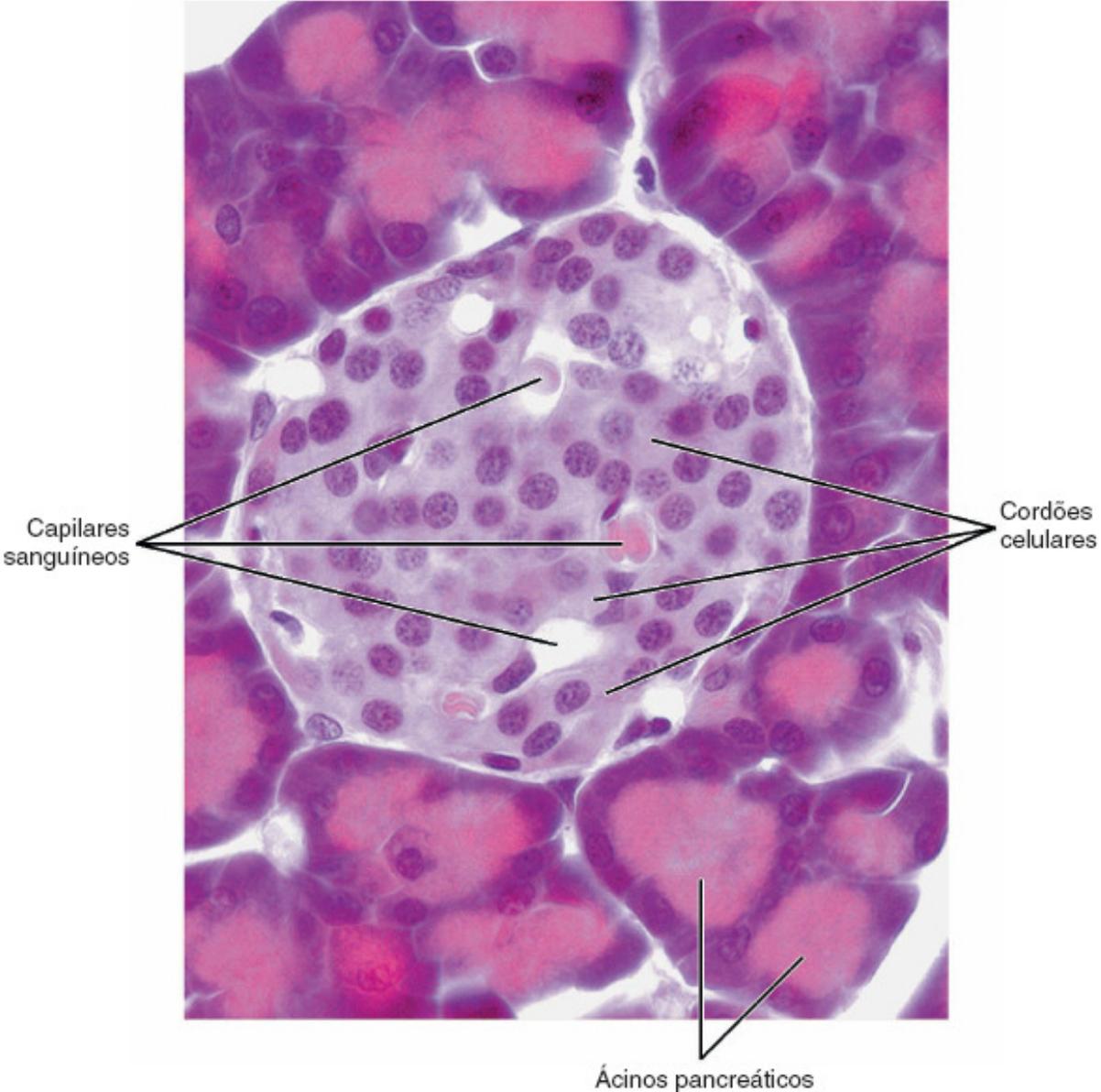
- pâncreas exócrino – ácinos e ductos pancreáticos
- pâncreas endócrino – Ilhotas de Langerhans
 - cerca de 1 milhão de Ilhotas por pâncreas
 - cordões de células entre capilares
 - cápsula de TC rico em fibras reticulares

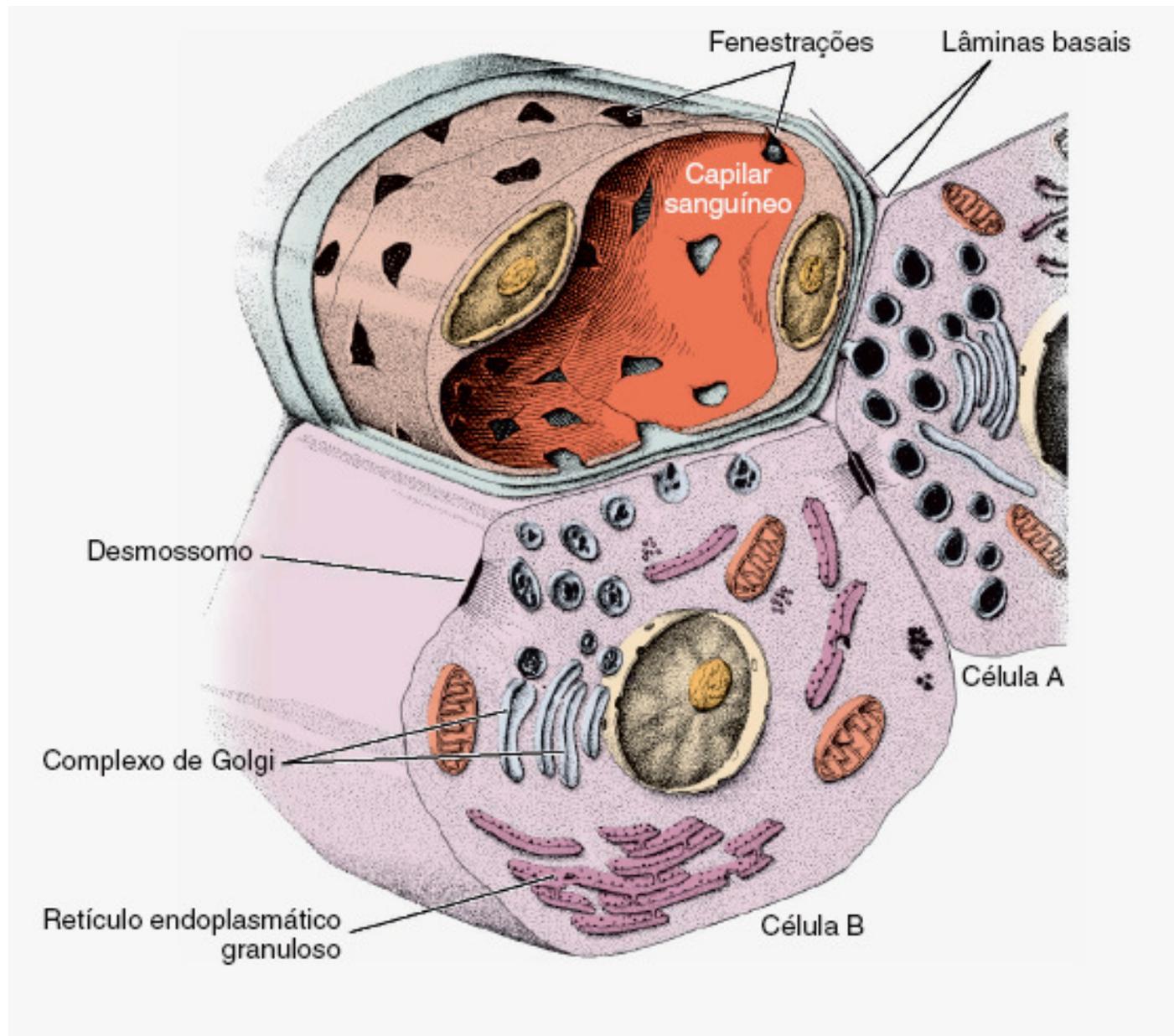
Ilhotas de Langerhans (hormônios)

- tipos celulares:
 - alfa (15-20%) - glucagon
 - beta (70-80%) - insulina
 - delta (10%)- gastrina e somatostatina
 - F (2%) – polipeptídio pancreático
 - outras- VIP, motilina, secretina

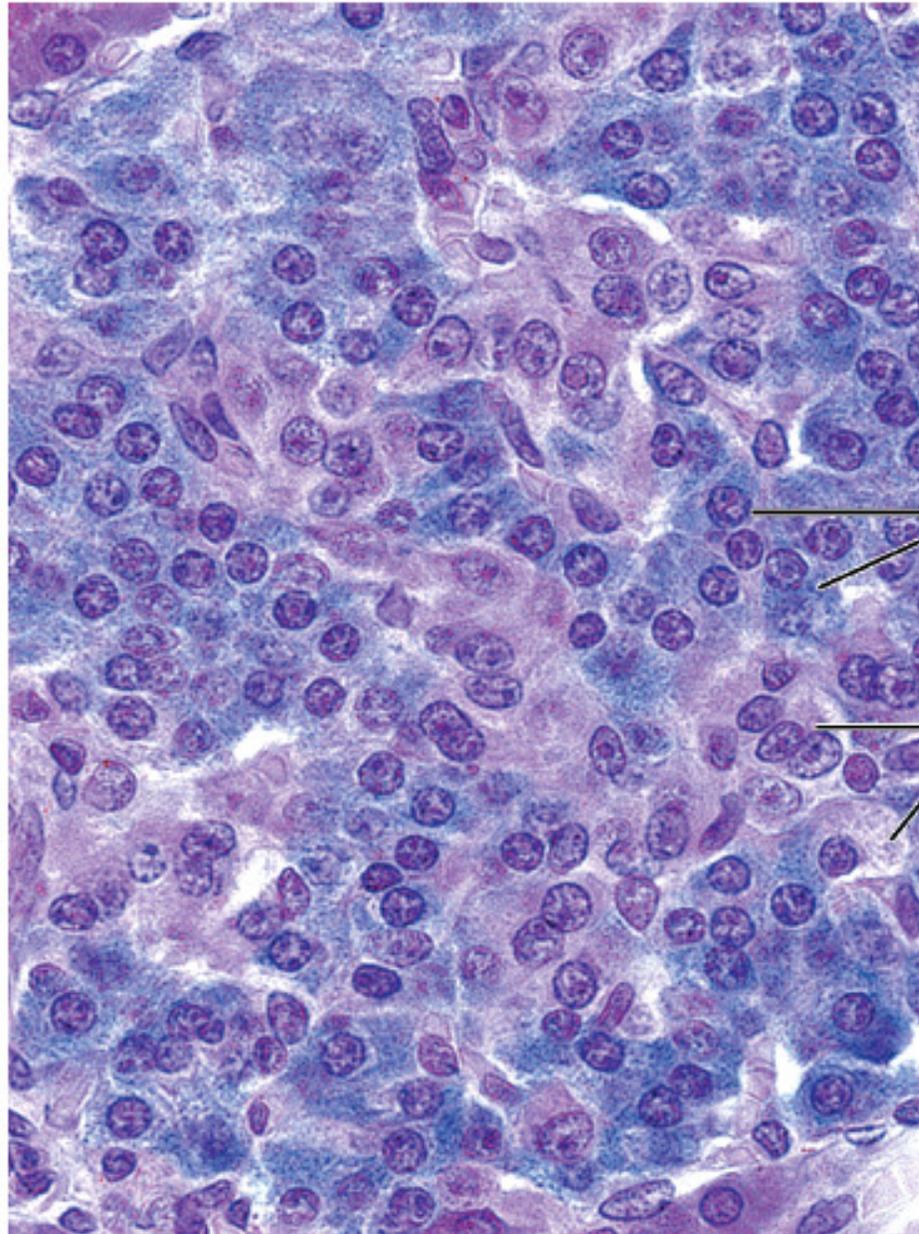


Ilhotas de Langerhans





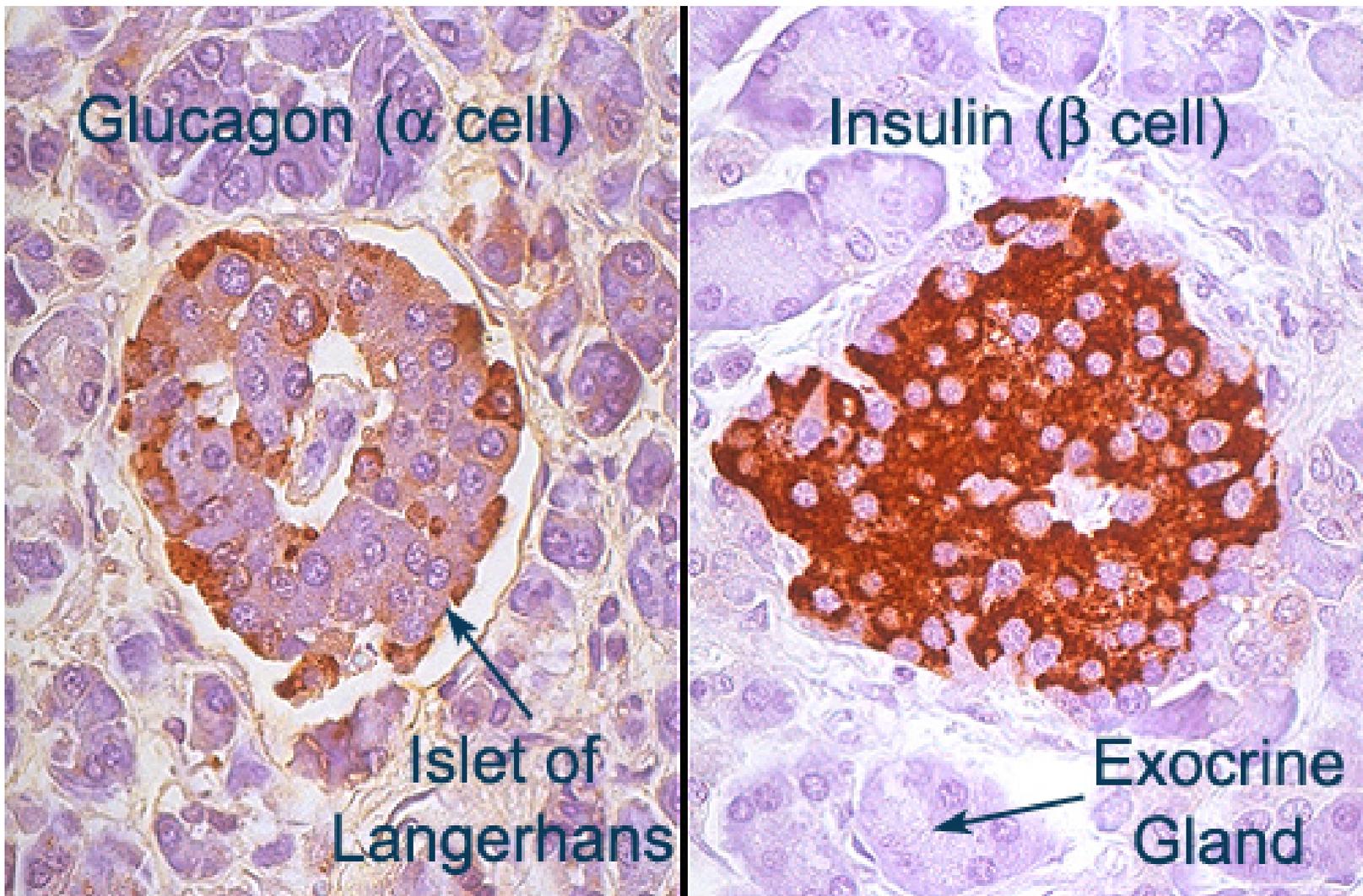
Ilhotas de Langerhans



Células B Insulina

Células A Glucagon

PÂNCREAS (ILHOTAS DE LANGERHANS)



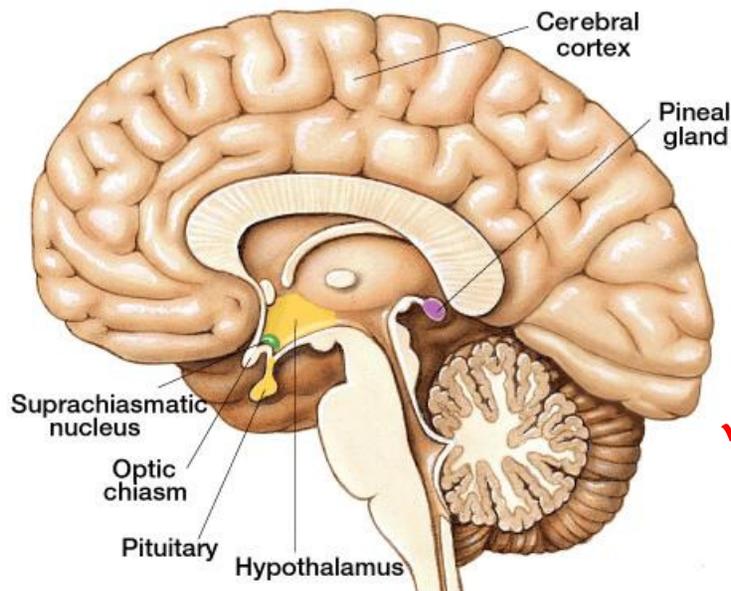
CÉLULA α

CÉLULA β

Sistema Endócrino

➤ Pineal (Epífise)

- glândula de função neuroendócrina
 - pinealócitos (melatonina, serotonina) e astrócitos
 - células intersticiais (semelhantes a células gliais)
 - vasos sanguíneos, revestida externamente pelas meninges – pia mater
 - corpora arenacea “areia cerebral” – depósitos de carbonato de cálcio em adultos na MEC



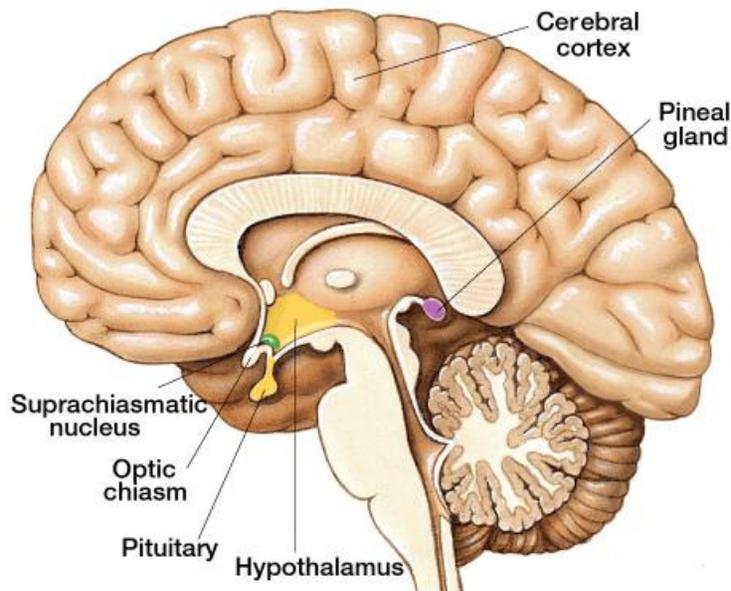
Localiza-se na extremidade posterior do terceiro ventrículo sobre o teto do diencefalo

✓ FUNÇÃO: Controle dos ritmos circadianos

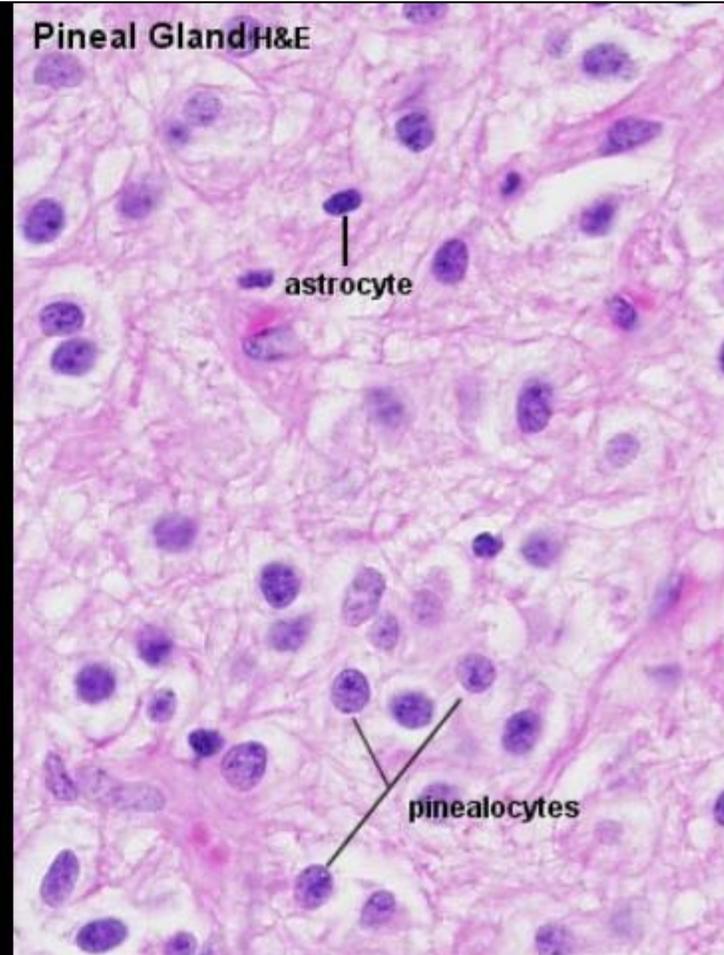
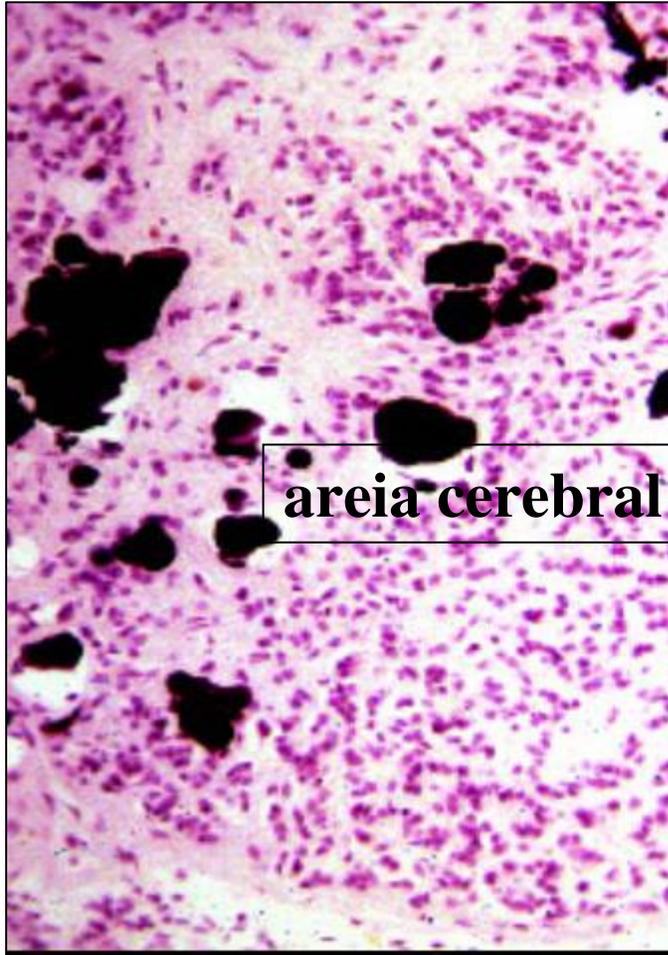
Sistema Endócrino

➤ Pineal (Epífise)

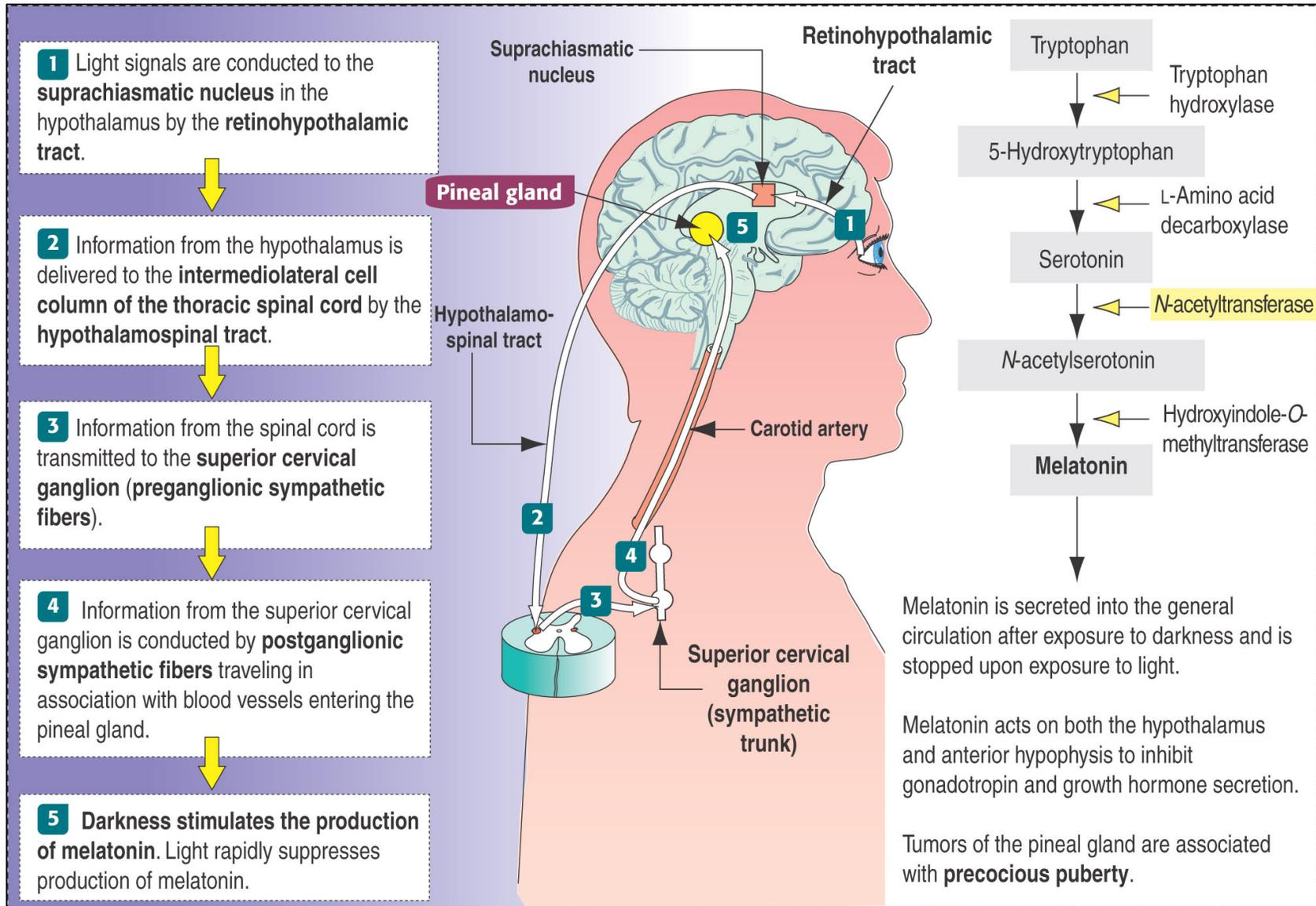
- glândula de função neuroendócrina
 - pinealócitos (melatonina, serotonina) e astrócitos
 - células intersticiais (semelhantes a células gliais)
 - vasos sanguíneos, revestida externamente pelas meninges
 - corpora arenacea “areia cerebral” – depósitos de carbonato de cálcio em adultos na MEC



Sistema Endócrino



Sistema Endócrino: Melatonina



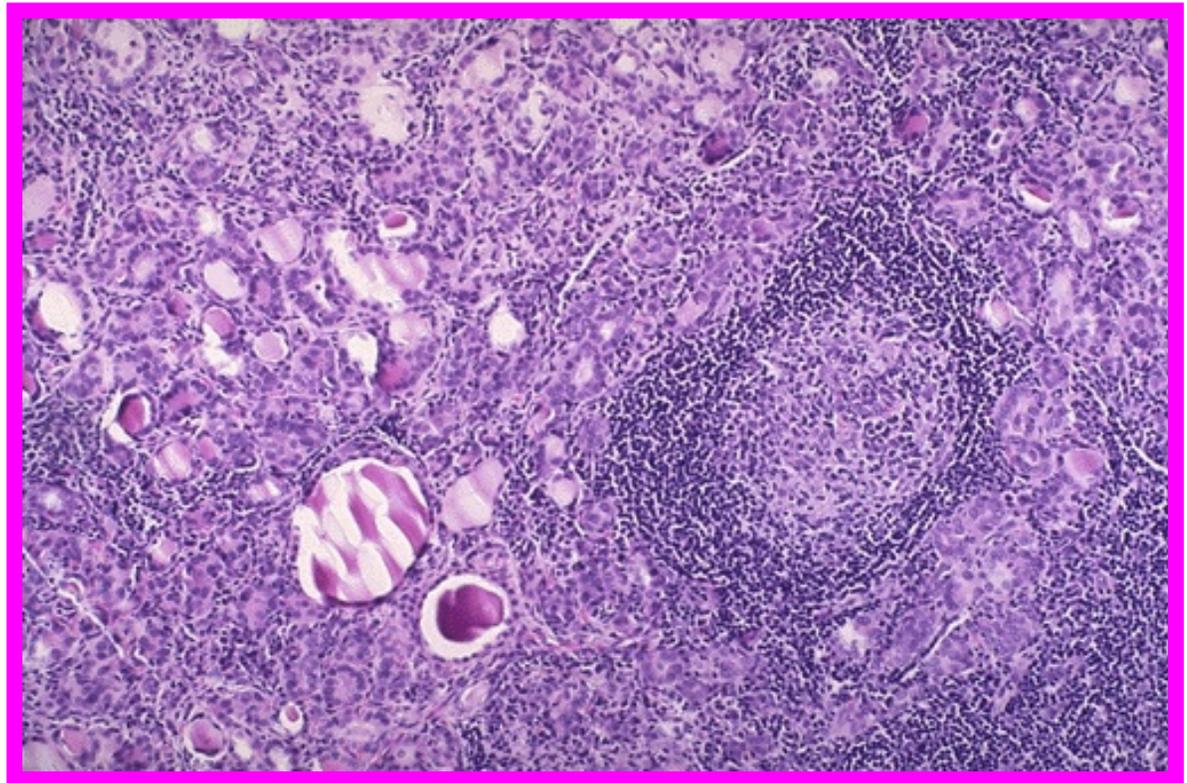
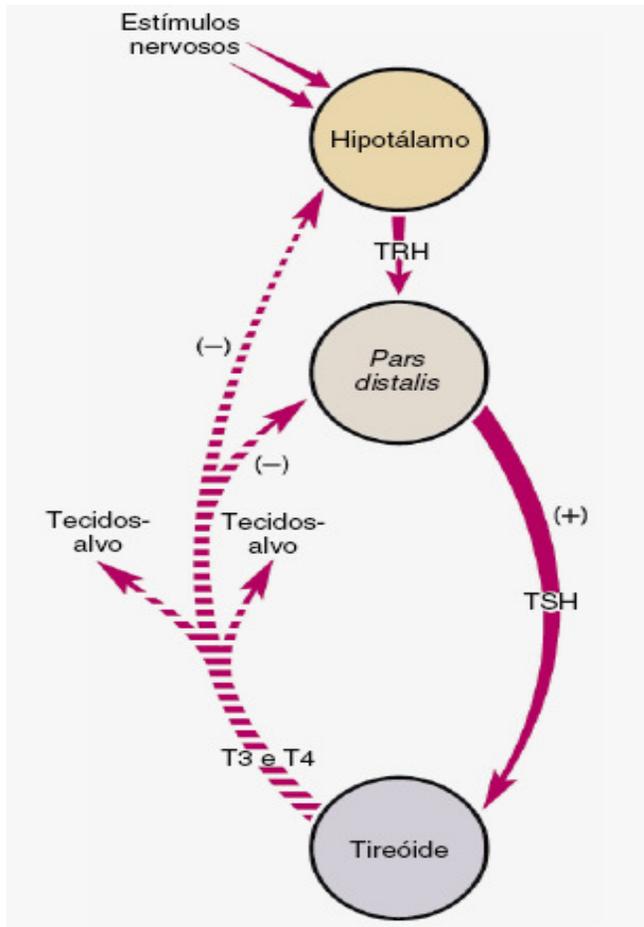
TIREÓIDE

ALTERAÇÃO DE FUNÇÃO

- HIPOFUNÇÃO (HIPOTIREOIDISMO)
- HIPERFUNÇÃO (HIPOTIREOIDISMO)

HIPOTIREOIDISMO

TIREOIDITE DE HASHIMOTO



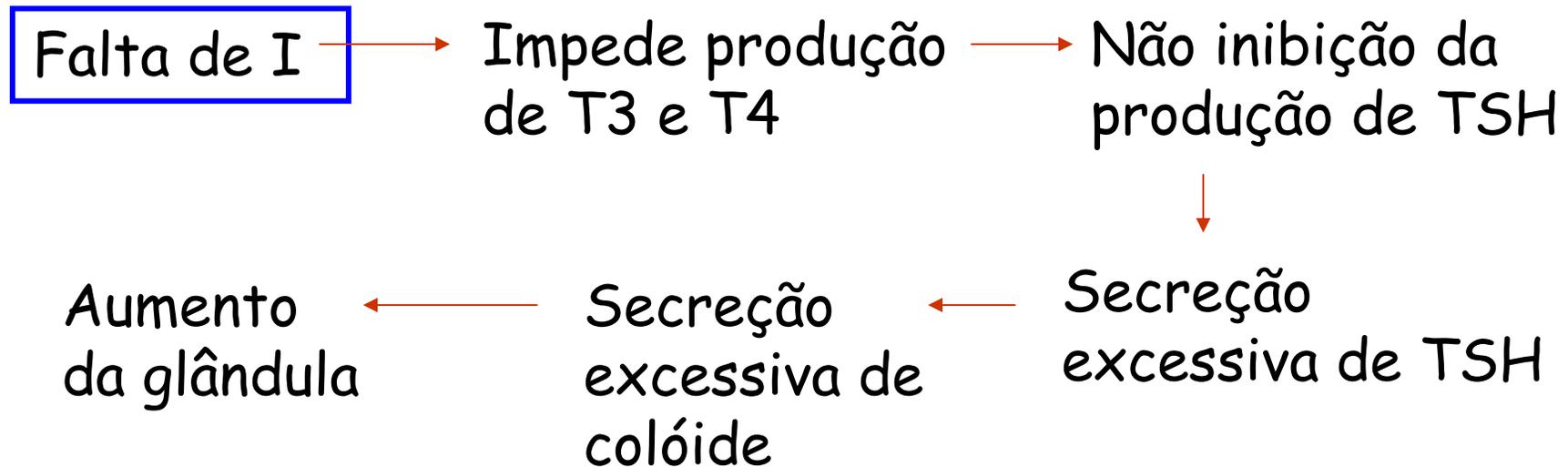
HIPOTIREOIDISMO

Bócio colóide endêmico

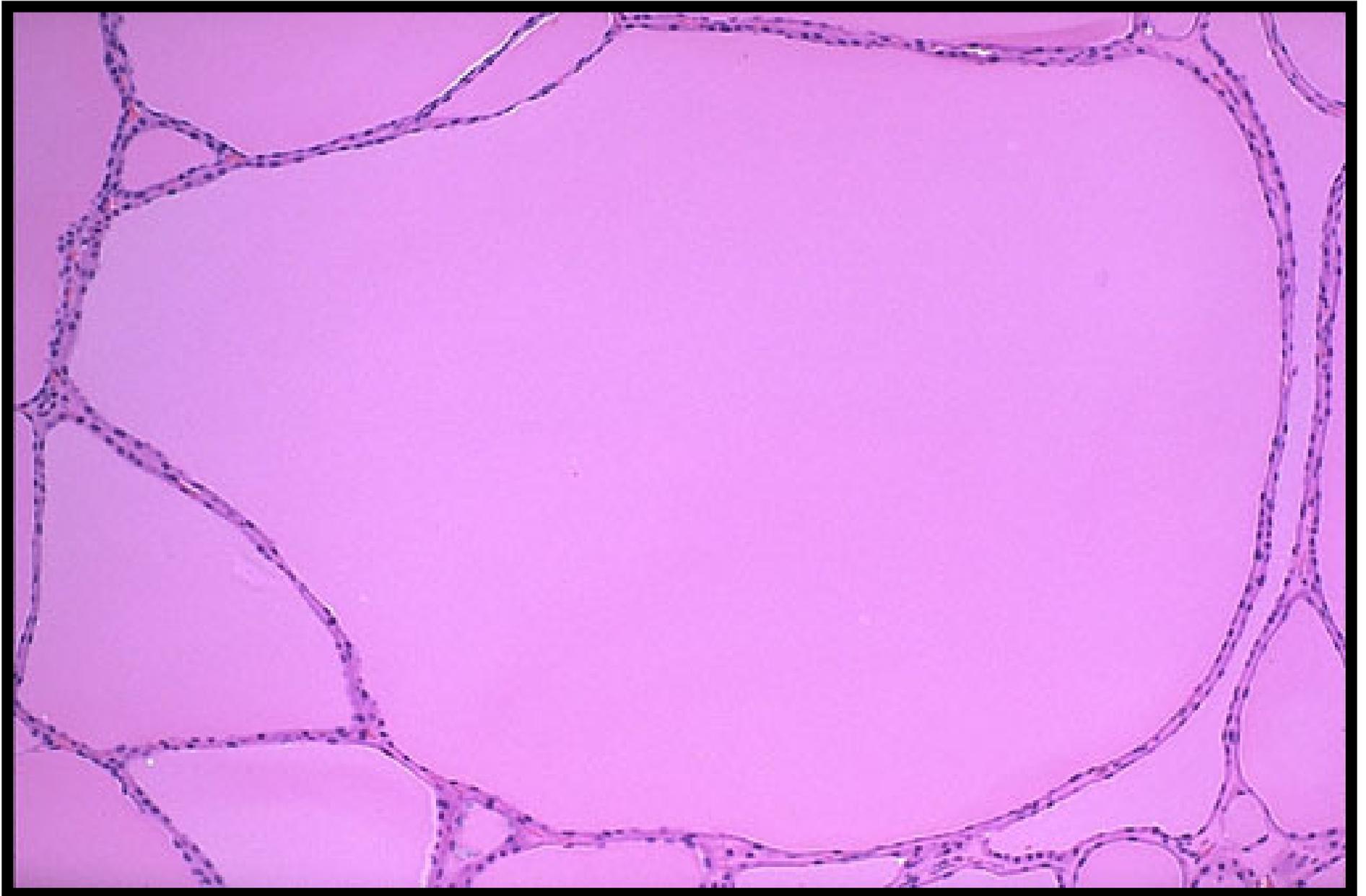
Desenvolvimento de um tamanho aumentado da glândula tireóide devido à falta de Iodo.

Bócio colóide endêmico

50mg I/ano → Quantidades adequadas de hormônios tireoidianos



Bócio colóide endêmico

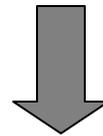


HIPERTIREOIDISMO

Doença de Graves

- Mecanismo é **autoimune**
- Produção de **anticorpos contra os receptores para TSH** situados na membrana plasmática das células foliculares.

Anticorpos + Receptor = TSH + Receptor



célula folicular é estimulada a secretar T3 e T4.

Doença de Graves

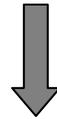
Anticorpos estimulam a secreção de T3 e T4, assim como o TSH



Células foliculares tornam-se grandes, cilíndricas ou cúbicas, com núcleos volumosos, devido à sua **maior atividade**

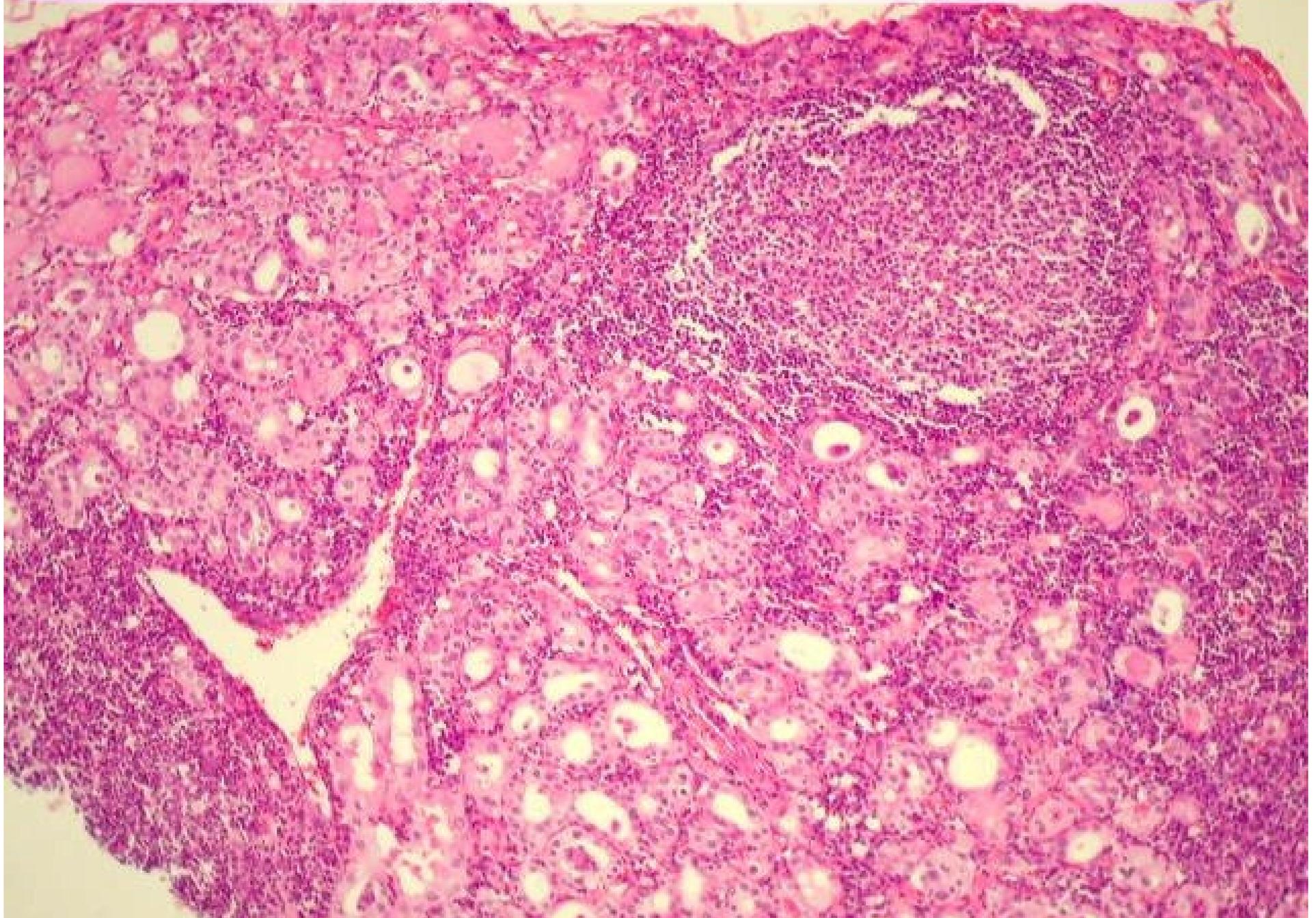


Quantidade de colóide na luz dos folículos **fica pequena**



célula **metaboliza o colóide** para liberar T3 e T4 no sangue circulante

FOLÍCULOS PEQUENOS COM POUCO COLOIDE



Doença de Graves

Infiltrado inflamatório

Há infiltrado linfoplasmocitário focal, formando folículos linfóides com centros germinativos. O infiltrado inflamatório é a expressão morfológica da natureza autoimune da doença.

