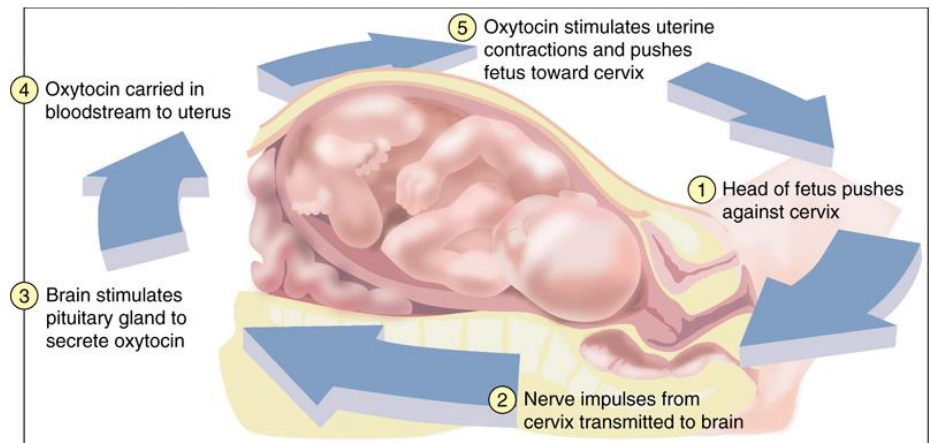
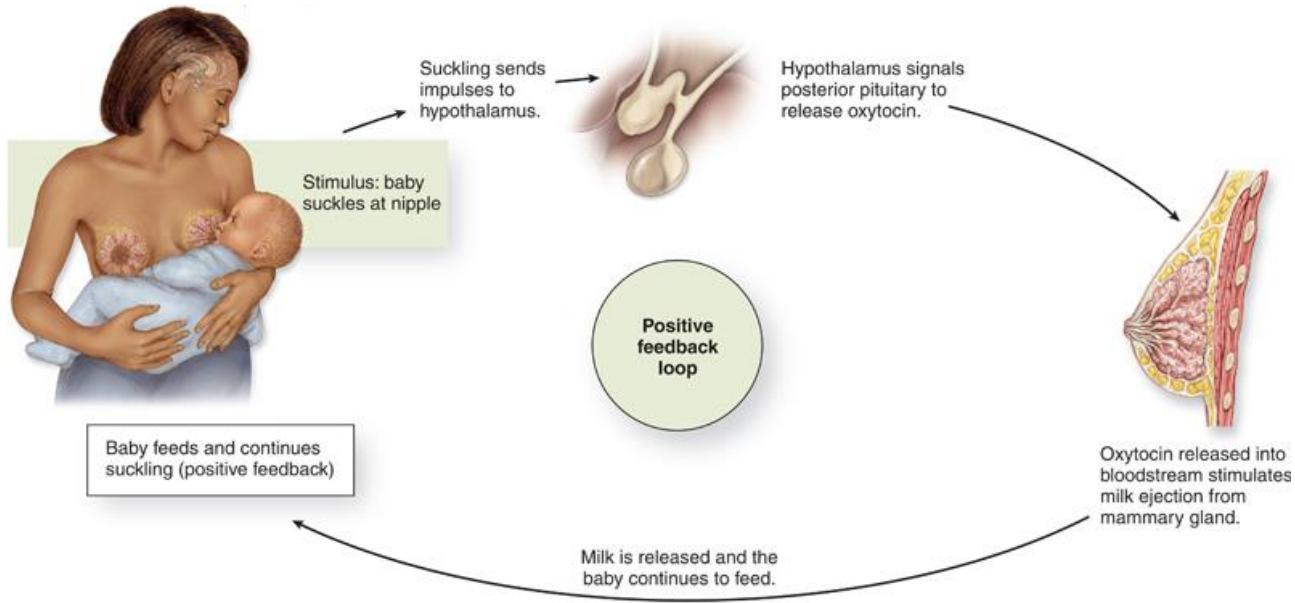
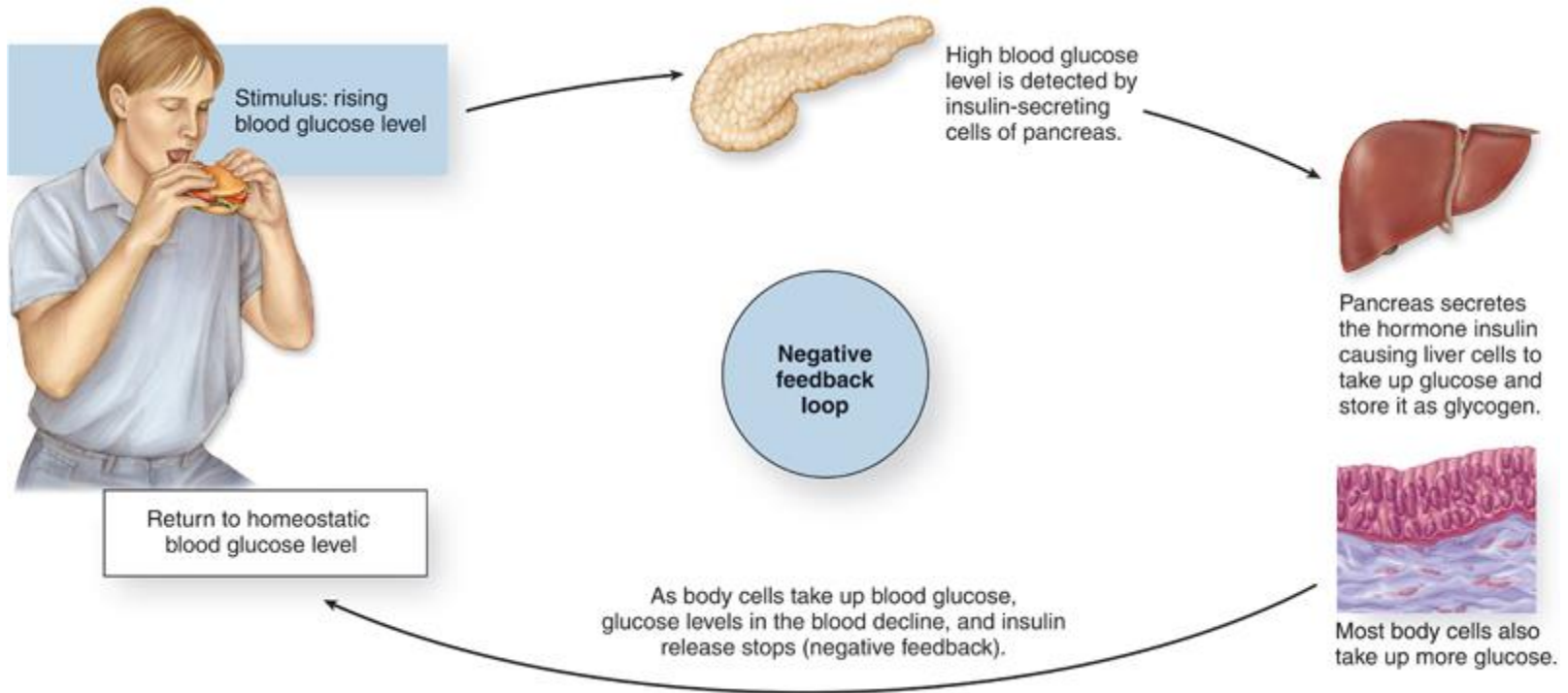


Endokrinní systém

Hormonální regulace



Hormonální regulace

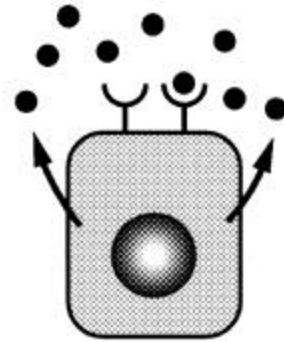




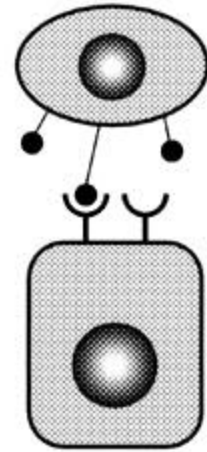
endocrine



paracrine



autocrine



juxtacrine

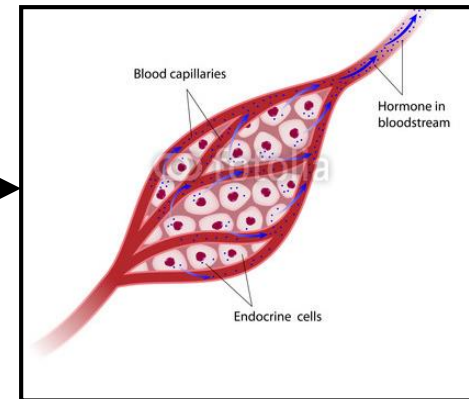
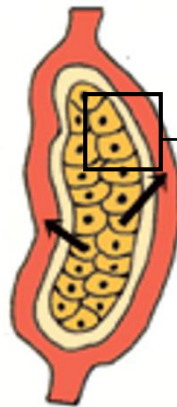
Endokrinní systém

- **Žlázy** (hypofýza, epifýza, štítná žláza, příštítná tělíska, nadledviny)
- **Součást jiných orgánů**
(pankreas, gonády, ledviny, placenta)
- **Endokrinní buňky** v epitelu, neuroendokrinní buňky, atd.

Obecná struktura:

- Vazivové pouzdro + septa
- Trámce žláзовého epitelu nebo skupinky žláзовých buněk
- Kapilární síť
 - Fenestrovane kapiláry
 - Sinusoidy

Exokrinní vs. Endokrinní žláza

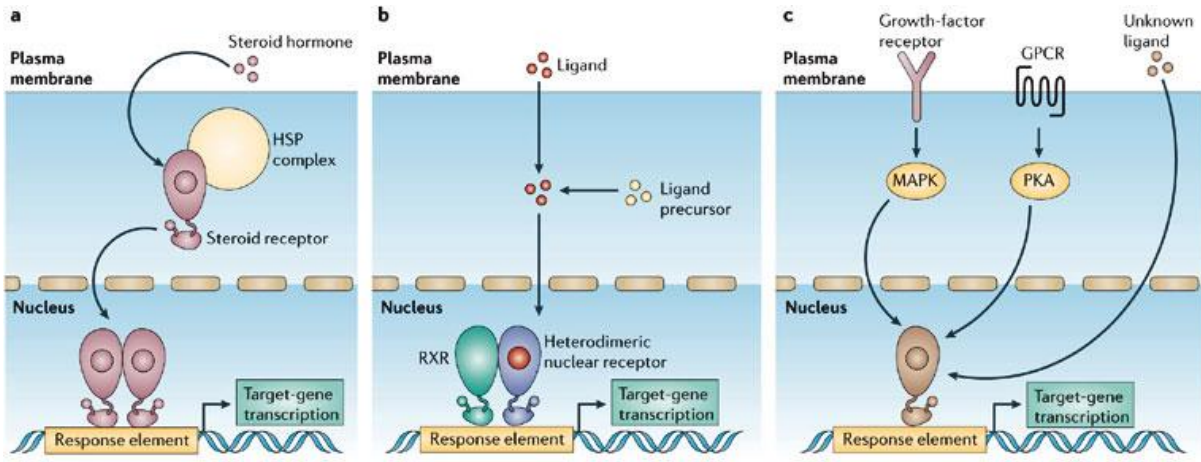
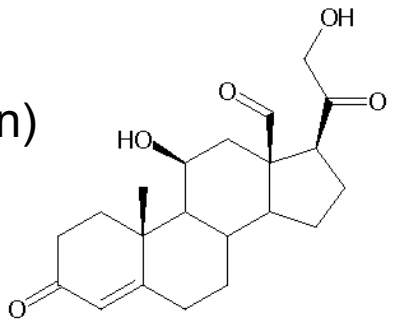


Charakter sekrece

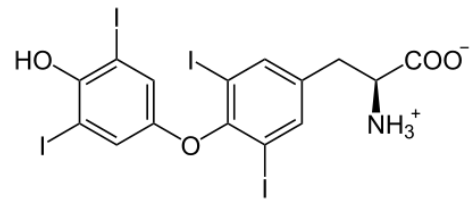
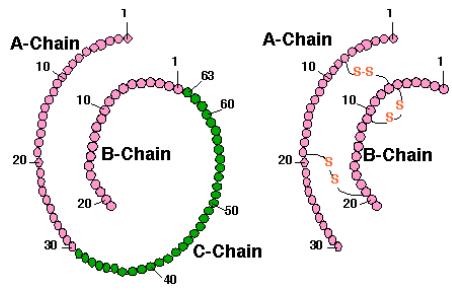
- autokrinní/parakrinní
- neurokrinní
- **endokrinní**

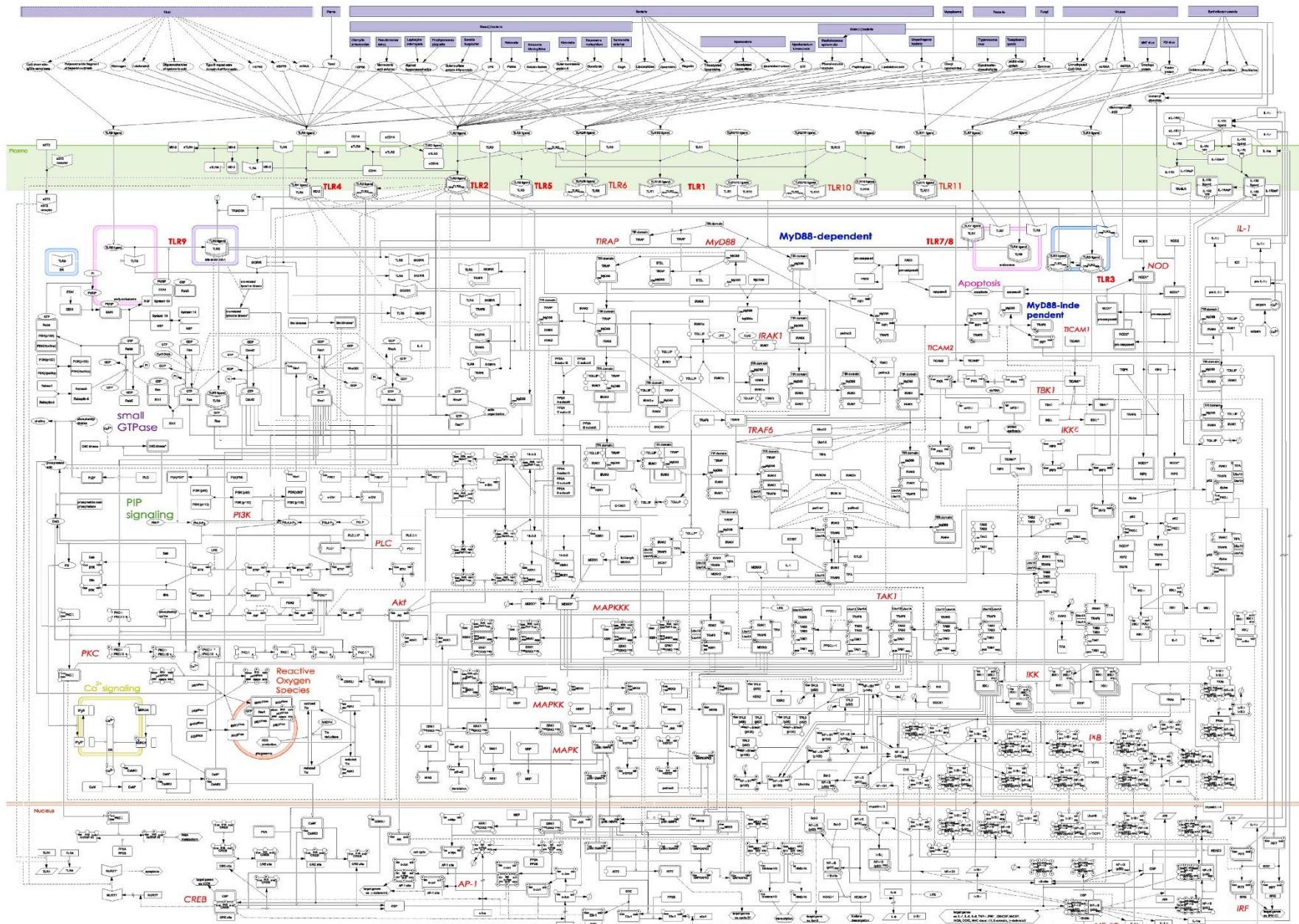
Hormony:

- **steroidy** – hydrofobní, intracytoplasmatické nebo jaderné receptory (pohlavní hormony, kortikoidy)
- **proteiny a polypeptidy** – hydrofilní, receptory na buněčné membráně (insulin, hormon adenohipofýzy, PTH, ...)
- **aminokyseliny** a jejich deriváty (adrenalin, noradrenalin, thyroxin)



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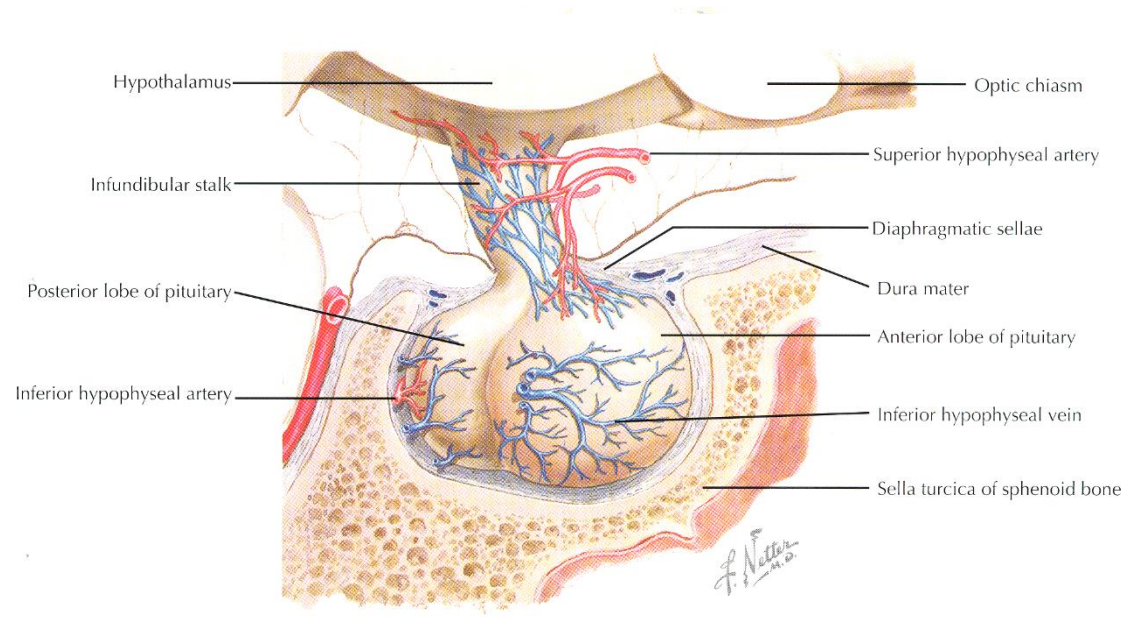
LEGENDS

Receptor	Ligand	Transmembrane protein	Small molecule	Enzyme	Protein	Degradation	Inhibitor	Activator	Nucleotide	DNA	RNA	Cytoskeleton	Lipid	Ion channel	Ion pump	Transcription factor	Transcription coactivator	Transcription repressor	Association	Termination	ADP/ATP	GTP/GDP

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 + Adobe Illustrator
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<http://cellDesigner.org/>

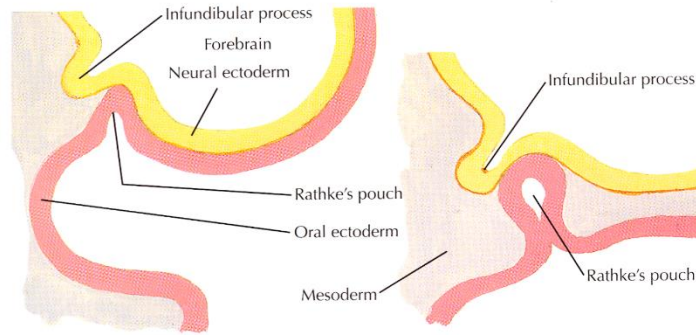
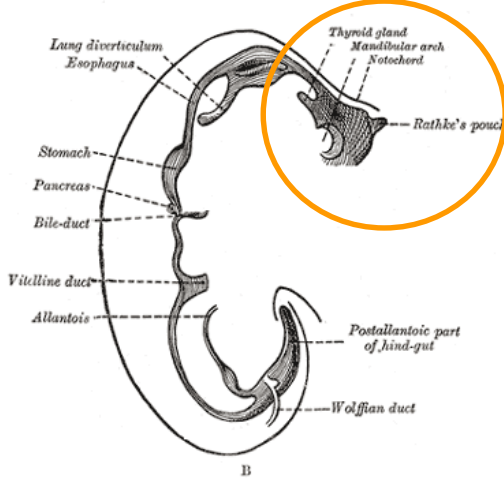
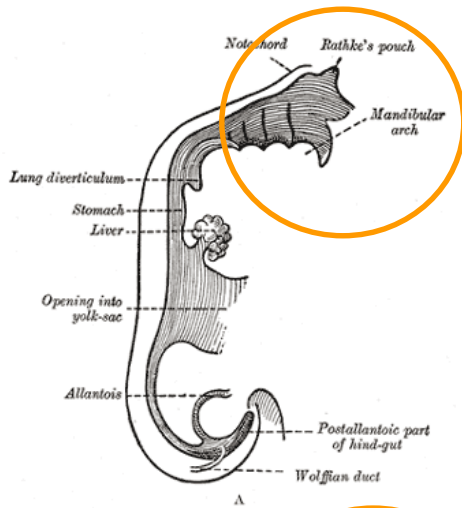
Hypofýza (gl. pituitaria)

Centrální postavení v lidském endokrinním systému

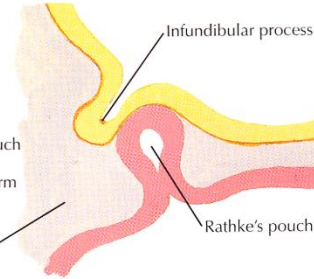


Dvojitý embryonální základ hypofýzy

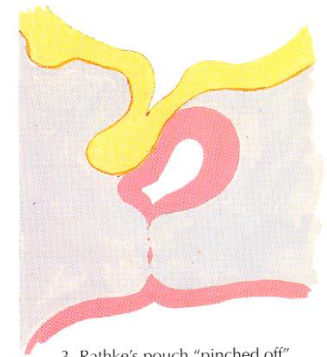
- Ektoderm (Rathkeho výchlípek)
- Neuroektoderm ventrální stěny diencefalonu



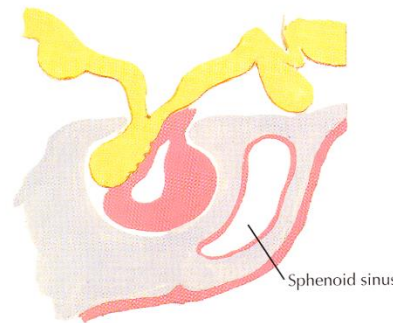
1. Beginning formation of Rathke's pouch and infundibular process



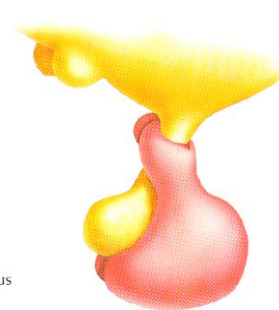
2. Neck of Rathke's pouch constricted by growth of mesoderm



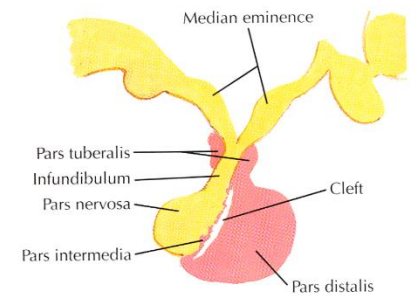
3. Rathke's pouch "pinched off"



4. "Pinched off" segment conforms to neural process, forming pars distalis, pars intermedia and pars tuberalis



5. Pars tuberalis encircles infundibular stalk (lateral surface view)

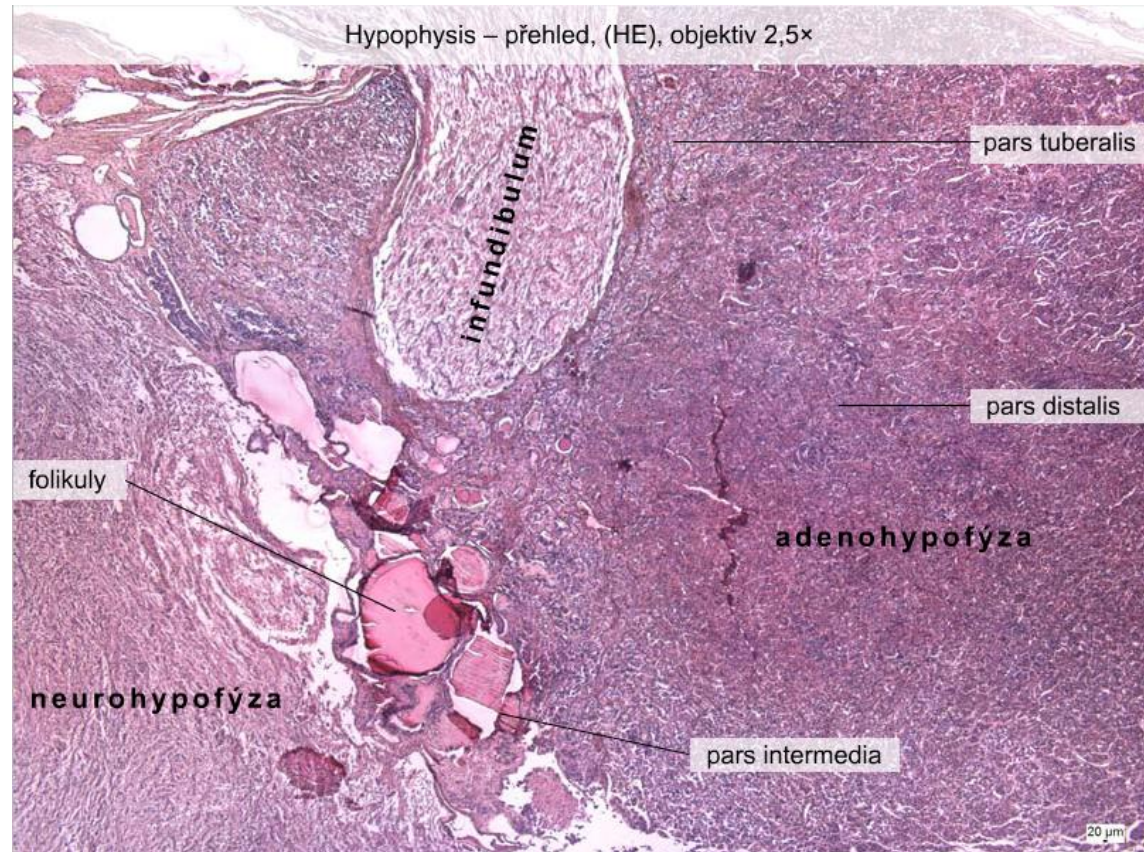


6. Mature form

F. Netter M.D.

Struktura:

- adenohypofýza (pars distalis, pars tuberalis, pars intermedia)
- neurohypofýza (pars nervosa)
- infundibulum



Adenohypofýza

Chromofilní buňky

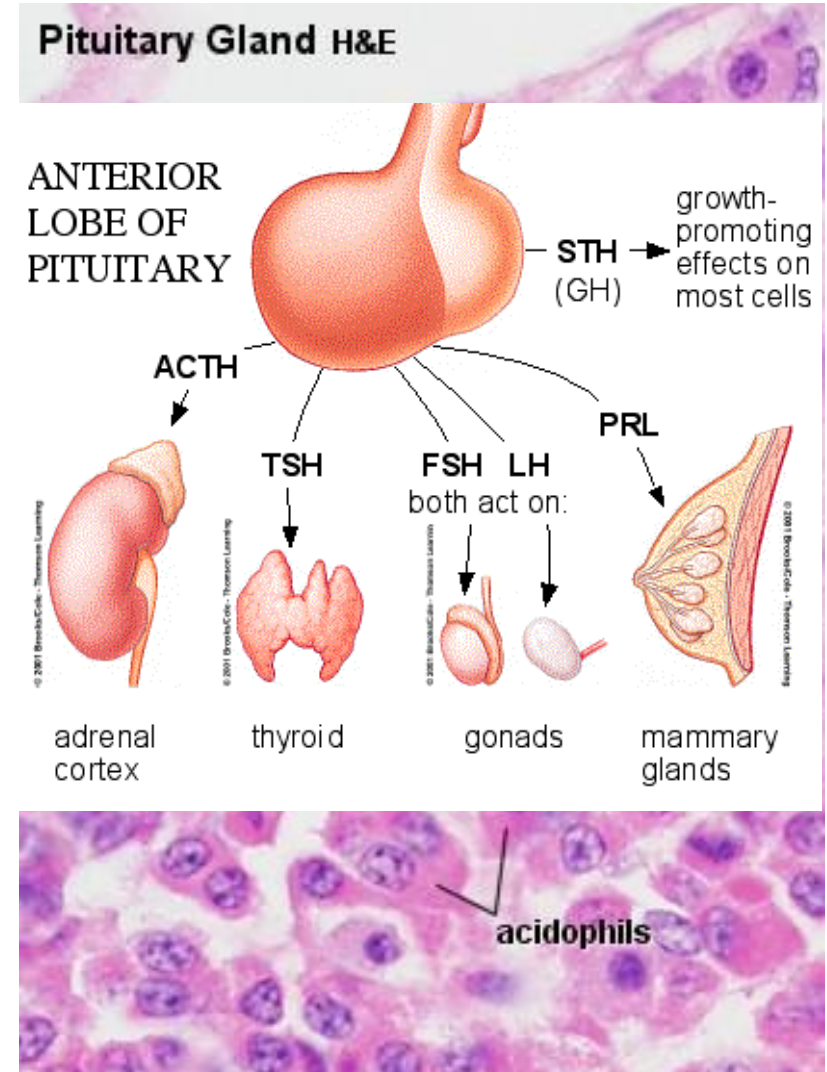
Acidofilní

- *Somatotropní* (STH, somatotropní)
- *Mammotropní* (LTH, prolaktin)

Basofilní

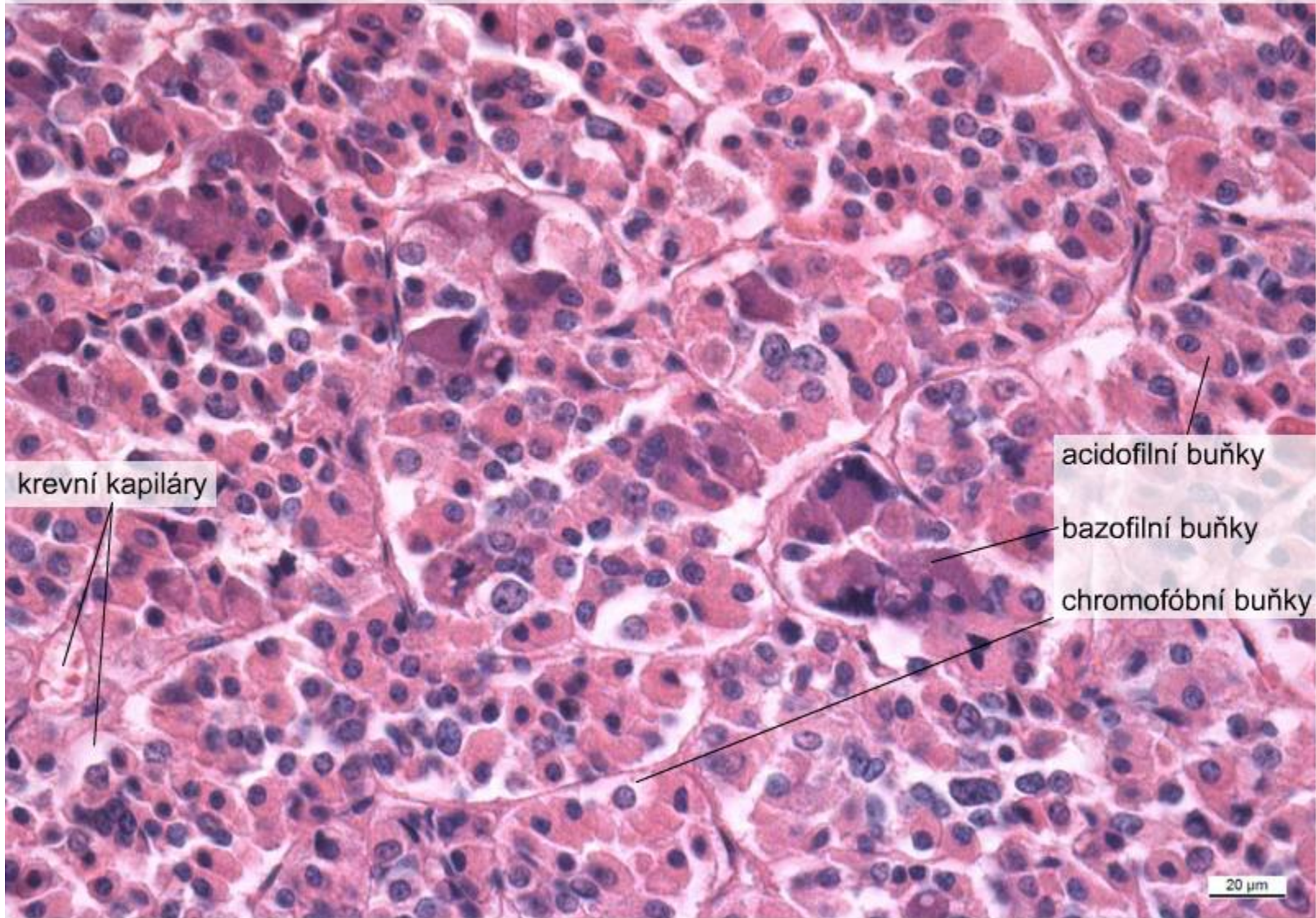
- *Thyreotropní* (TSH, tyreotropní)
- *Gonadotropní* (FSH, LH)
- *Kortikotropní* (ACTH, adrenokortikotropní)

Chromofobní buňky

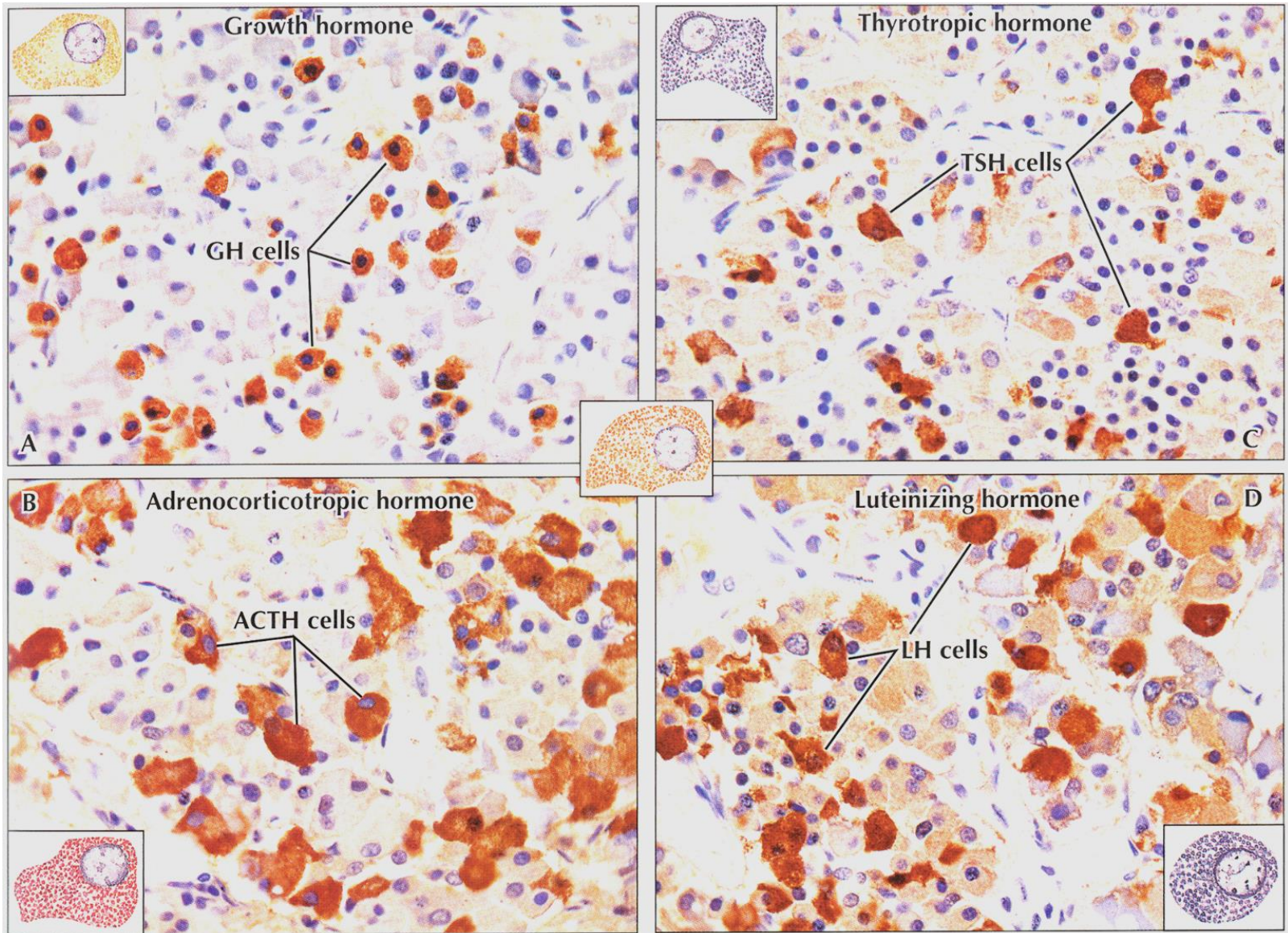


Adenohypophysis

Hypophysis – přední lalok, (HE), objektiv 20×



Adenohypofýza



Neurohypofýza

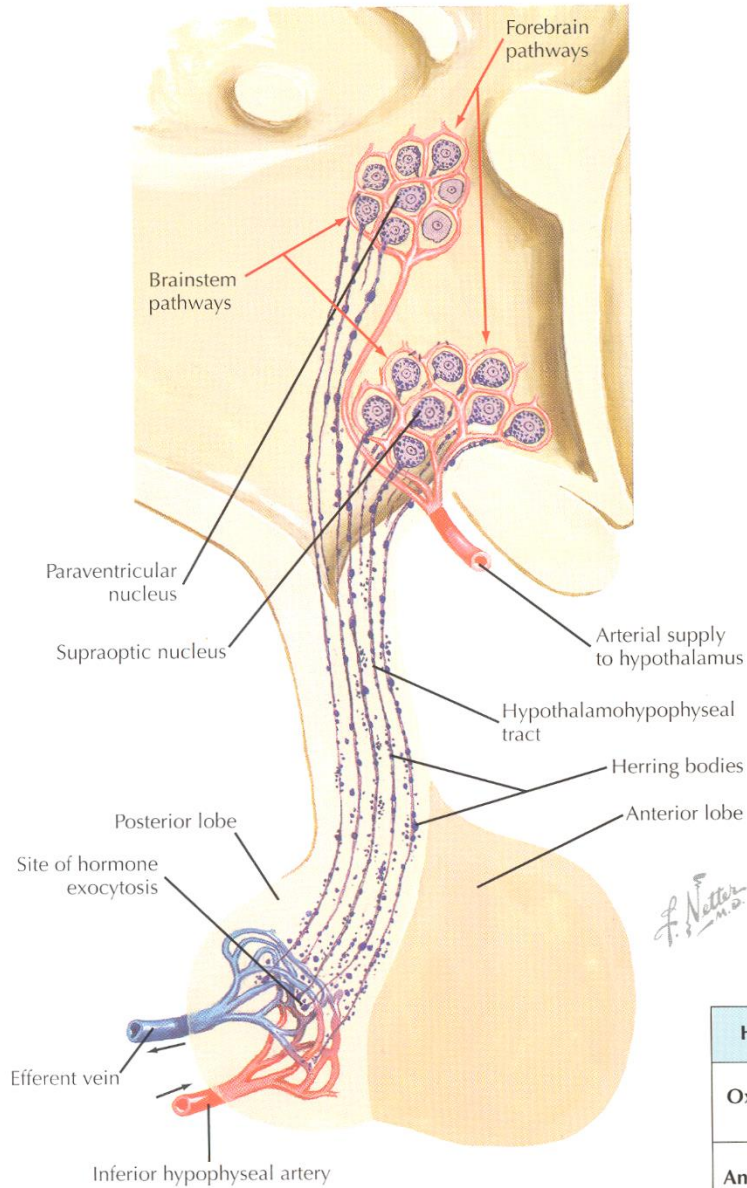
Struktura

- **Nemyelinizovaná nervová vlákna** – axony neurosekrečních buněk hypotalamických jader (n. supraopticus a paraventricularis)
- **pituicyty** (neuroglie)

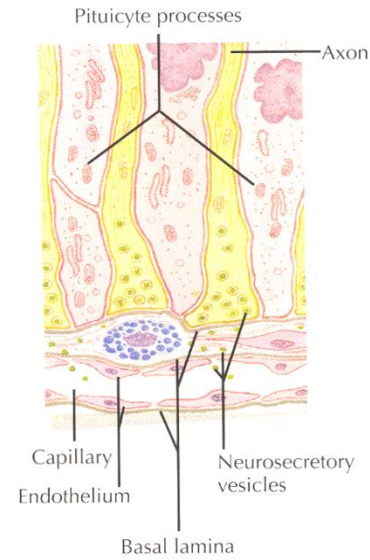
Hormony

- *oxytocin* (OT)
- *antidiuretický hormon* (ADH, vasopressin)

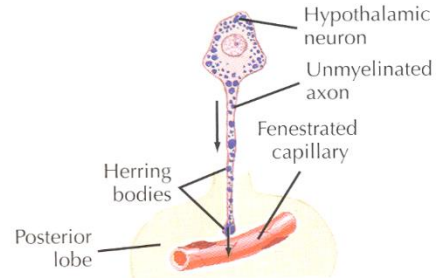
Herringova tělíška – neurosekreční zakončení – dilatace poblíž kapilár



▼ Neurosecretory Ending (posterior pituitary).



▼ Origin of ADH.



Hormone	Principal Action	Principal Nucleus of Origin
Oxytocin (OXY)	Uterine contraction, milk ejection	Paraventricular
Anti-diuretic hormone (ADH)	Water excretion in kidney, arteriolar constriction	Supraoptic

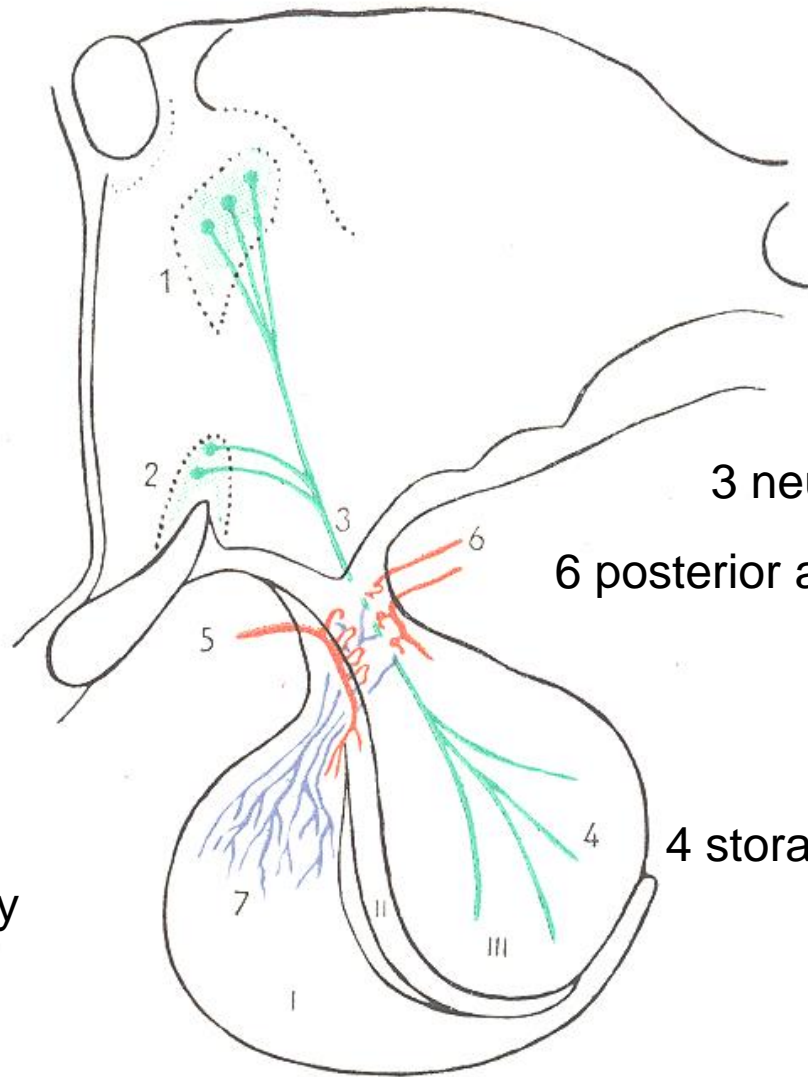
1 n. paraventricularis

2 n. supraopticus

5 anterior arteries

7 Secondary capillary network in anterior hypophysis

I, II adenohypophysis
III neurohypophysis

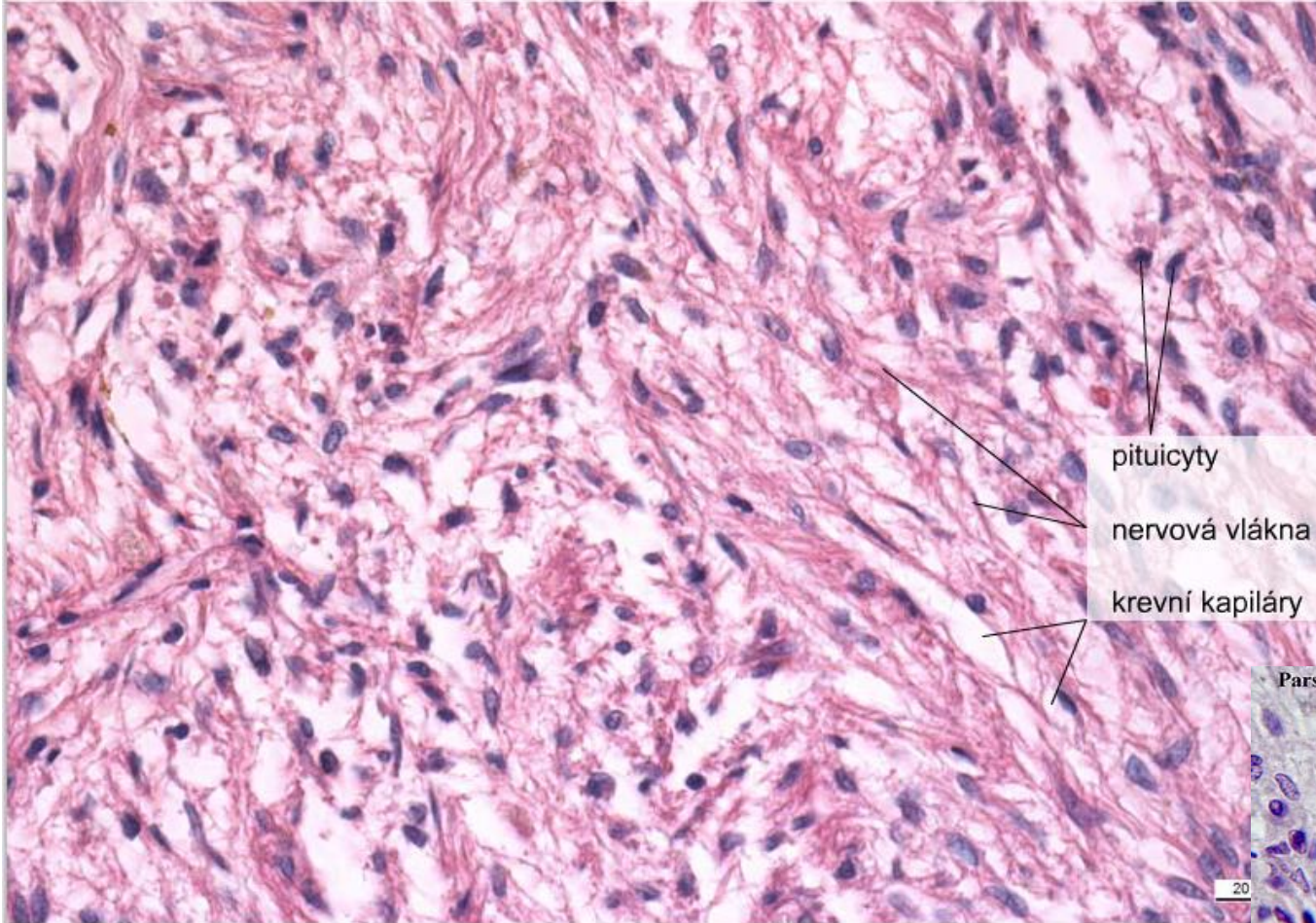


3 neurosecretion pathway

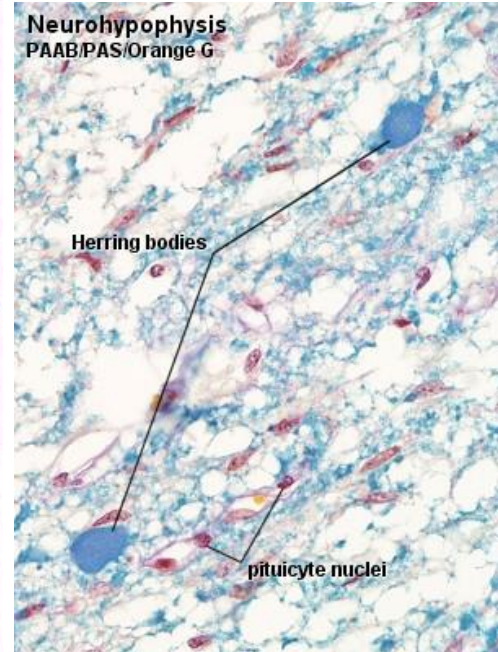
6 posterior arteries

4 storage in posterior hypophysis

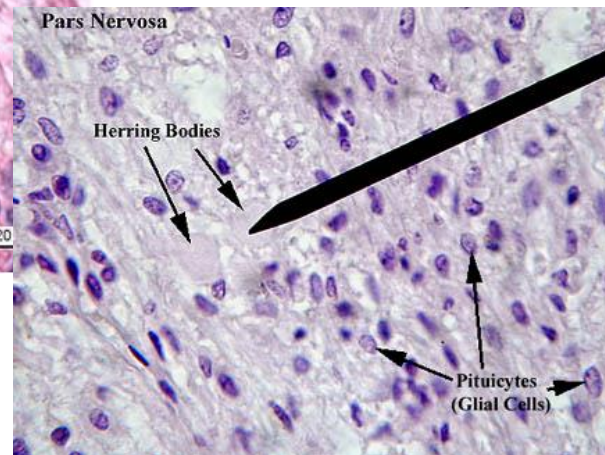
Hypophysis – zadní lalok, (HE), objektiv 40×

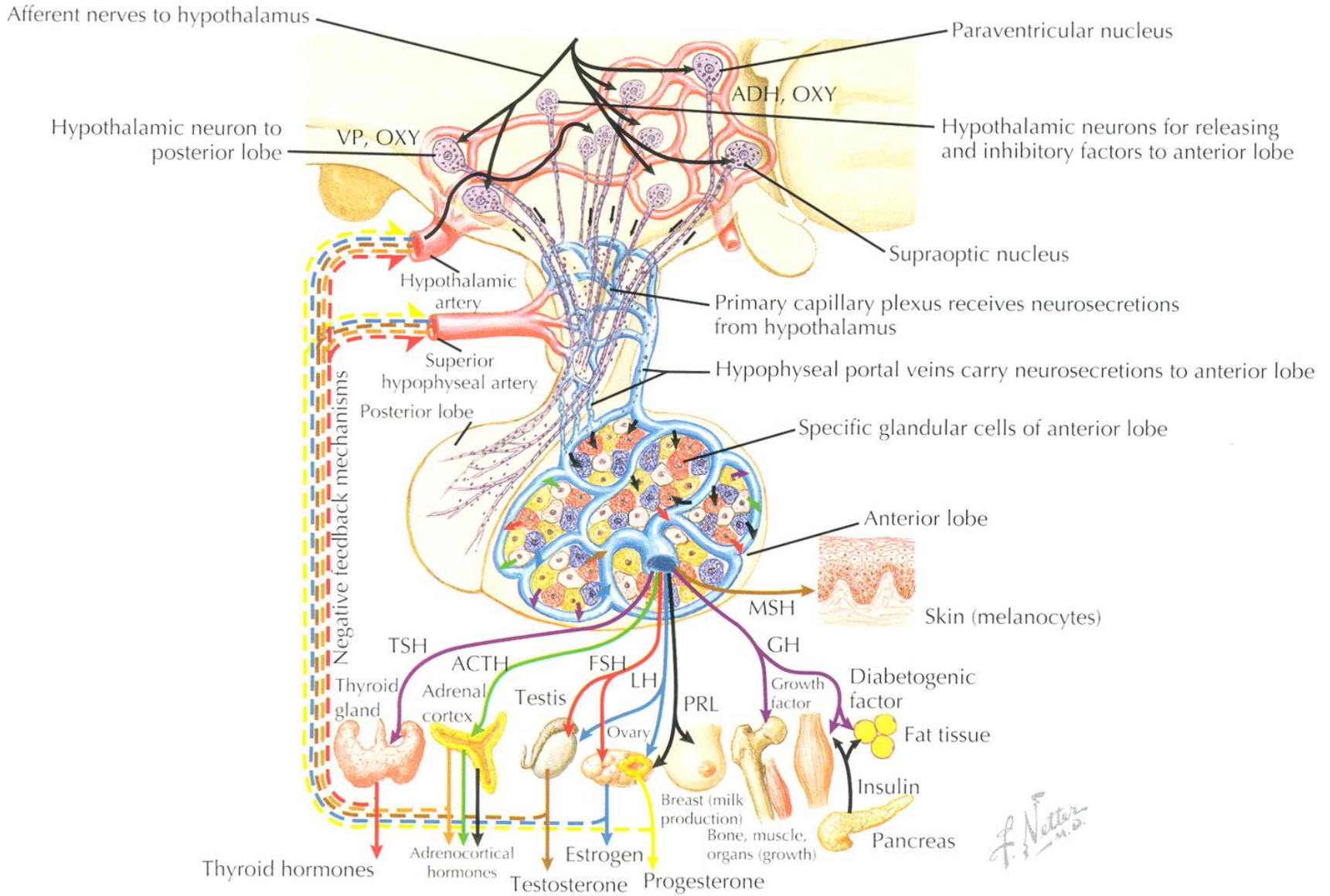


Neurohypophysis
PAAB/PAS/Orange G

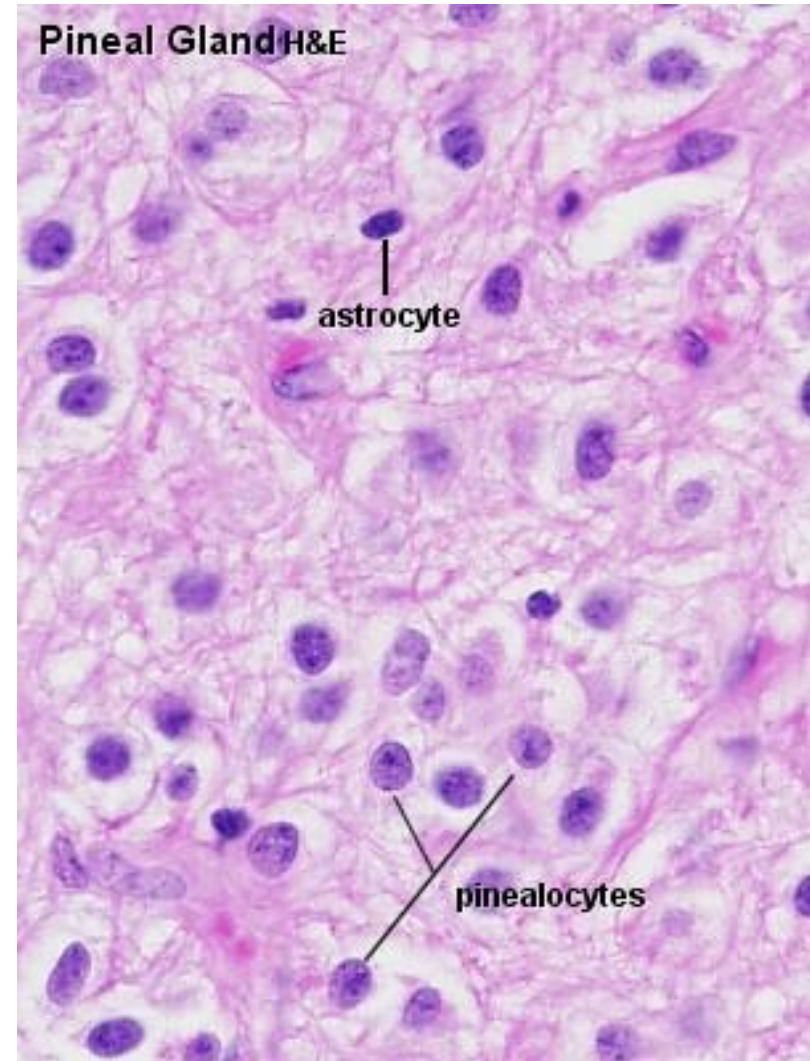
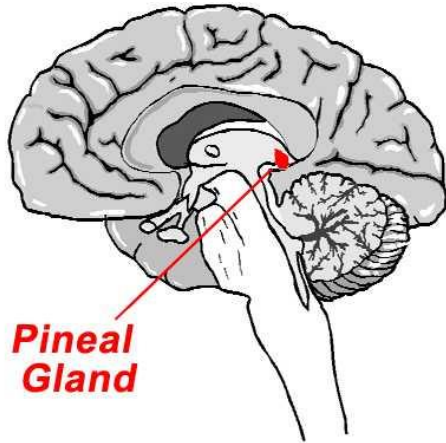


Pars Nervosa



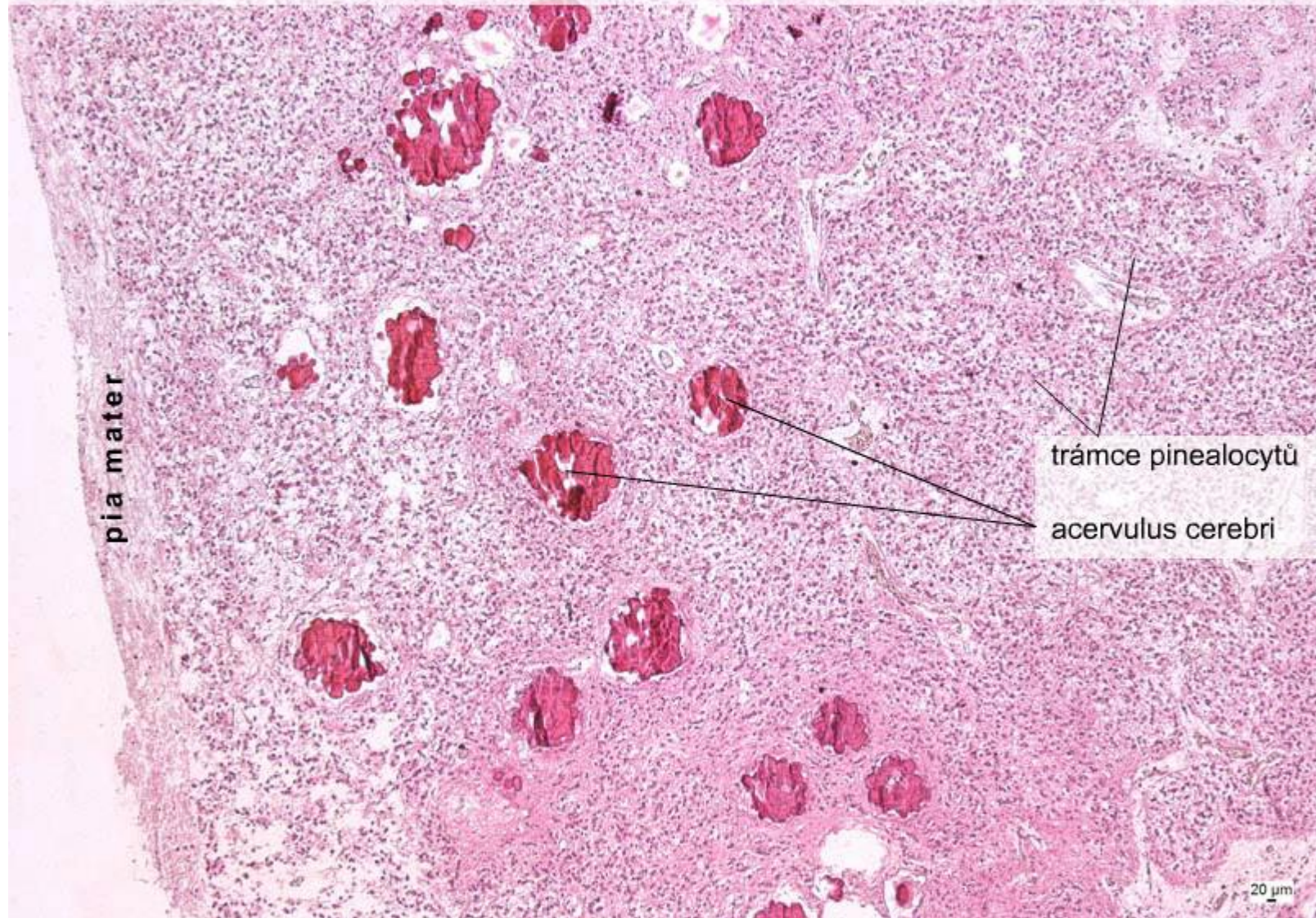


Epifýza (c. pineale)



- Vazivové pouzdro + septa
- Nemyelinizovaná nervová vlákna
 - *pinealocyty* (95%, velké, světlé, kulatá jádra)
 - *astrocyty* (glie; tmavém podlouhlá jádra)
- melatonin

Epiphysis, (HE), objektiv 5×



pia mater

trámce pinealocytů

acervulus cerebri

20 μm

Štítná žláza (gl. thyroidea)

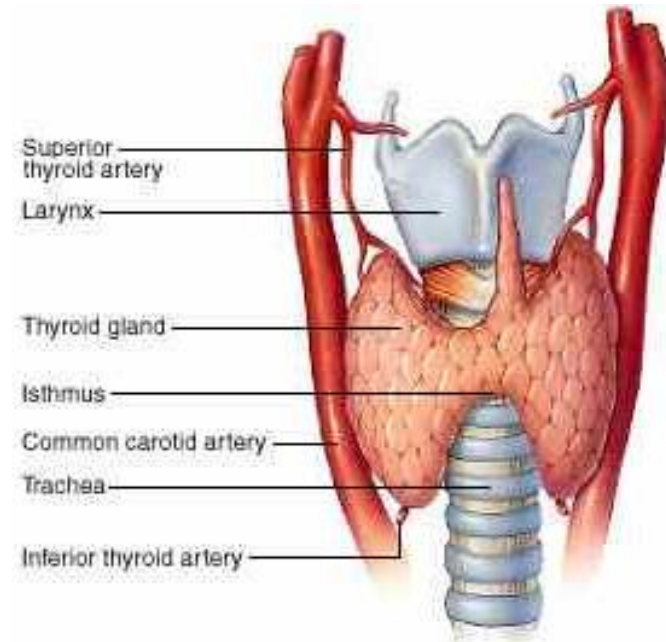
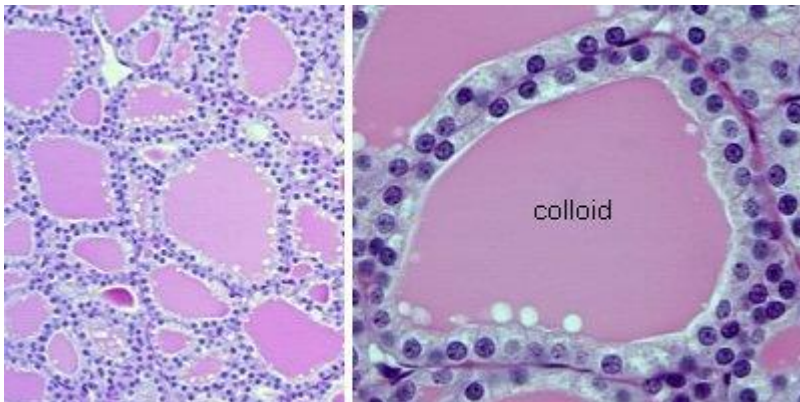
- Thyroidní hormony (**T3, T4**)
- **C buňky** *calcitonin*,

Vazivový obal + septa

Laloky → lalůčky - **folikuly**

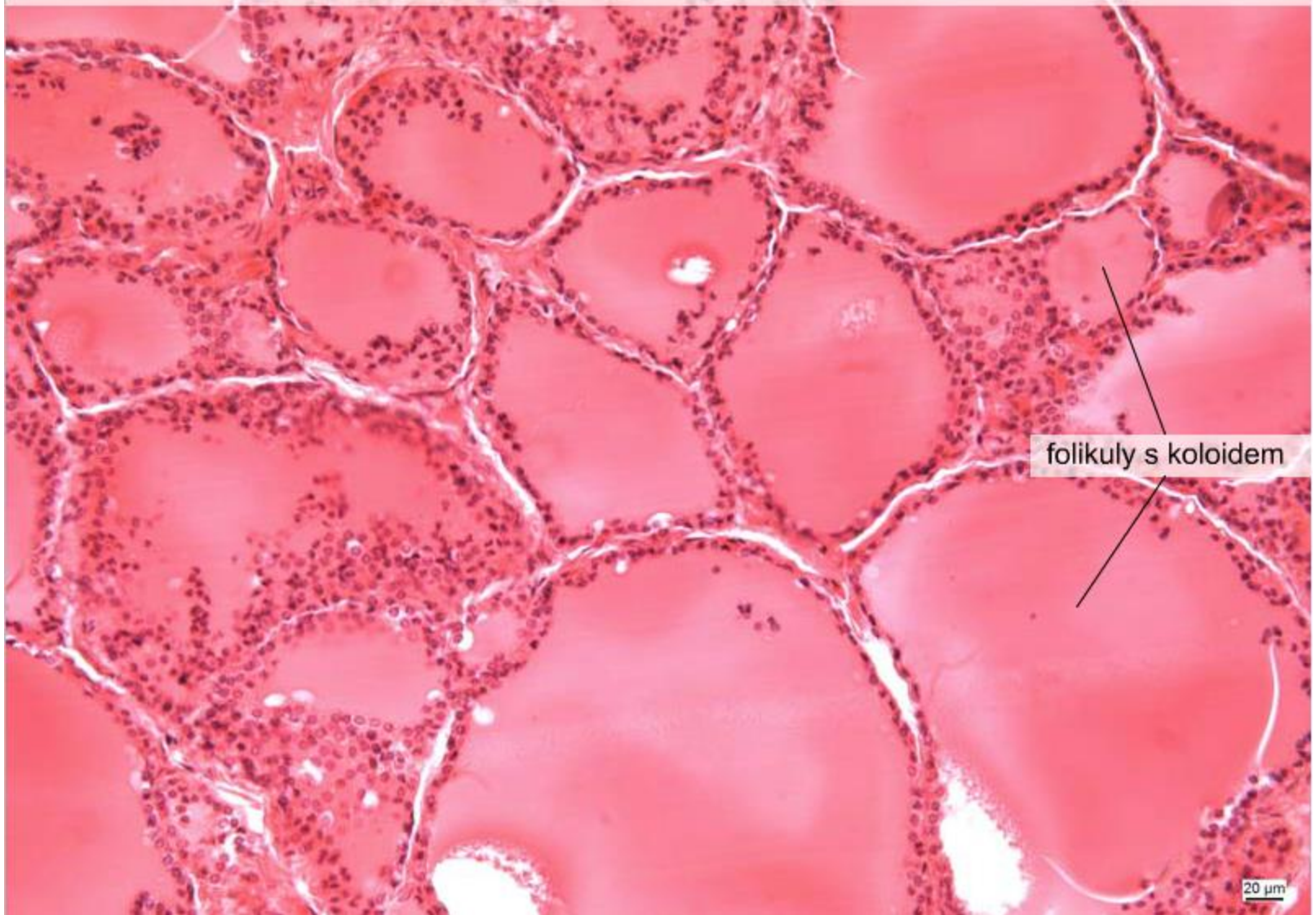
Folikuly (50 μm - 1 mm)

- Odděleny řídkým vazivem
- Jednoduchý kubický epitel
- Koloid



20 g

Glandula thyroidea, (HE), objektiv 20×



folikuly s koloidem

20 μm

Thyroid gland - follicles

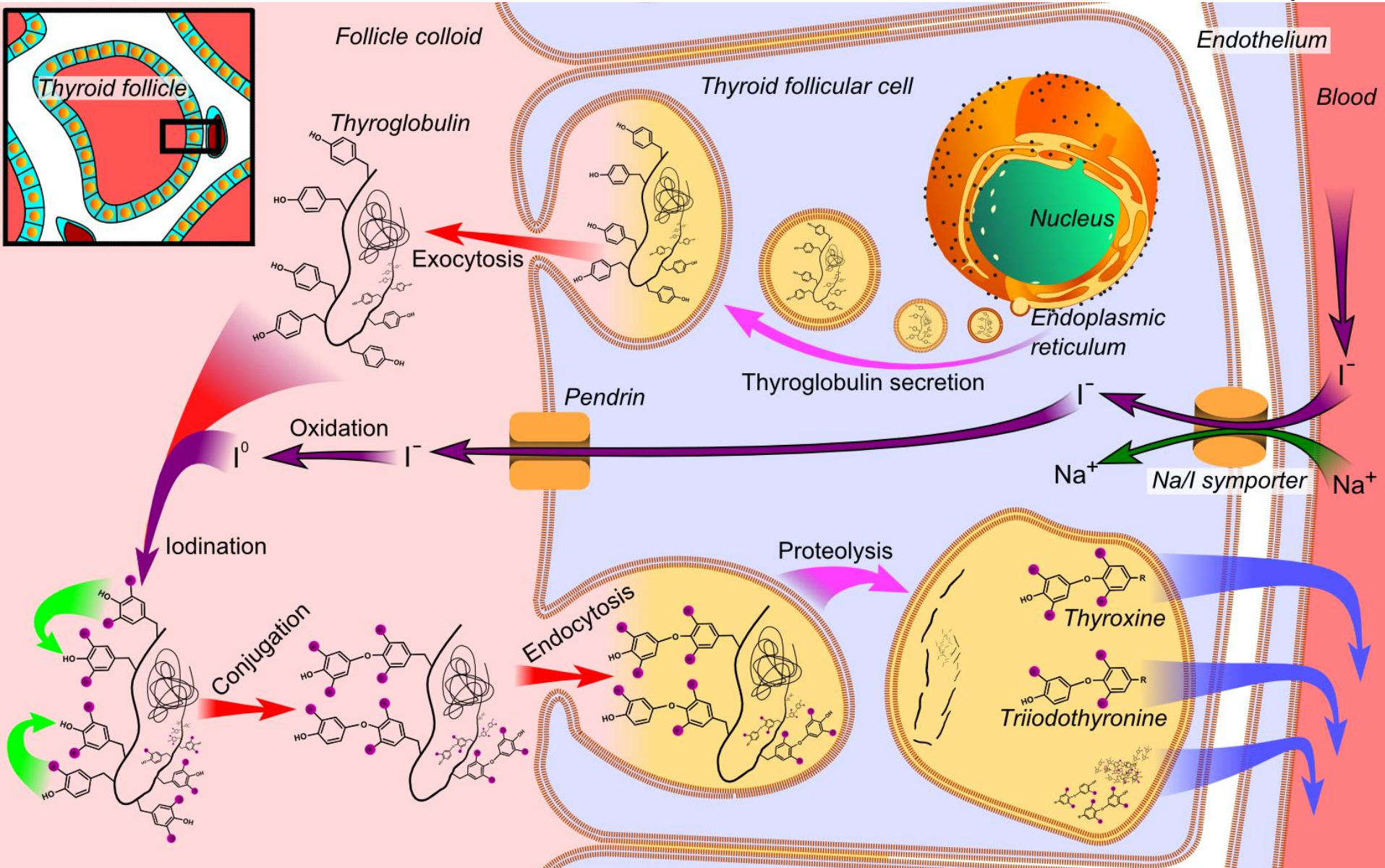


C buňky (parafolikulární) - báze epitelu, bez kontaktu s koloidem

thyreoglobulin

trijodothyronin T_3

tetraiodothyronin (thyroxin) T_4



Přistitná žláza (gl. parathyreoidea)

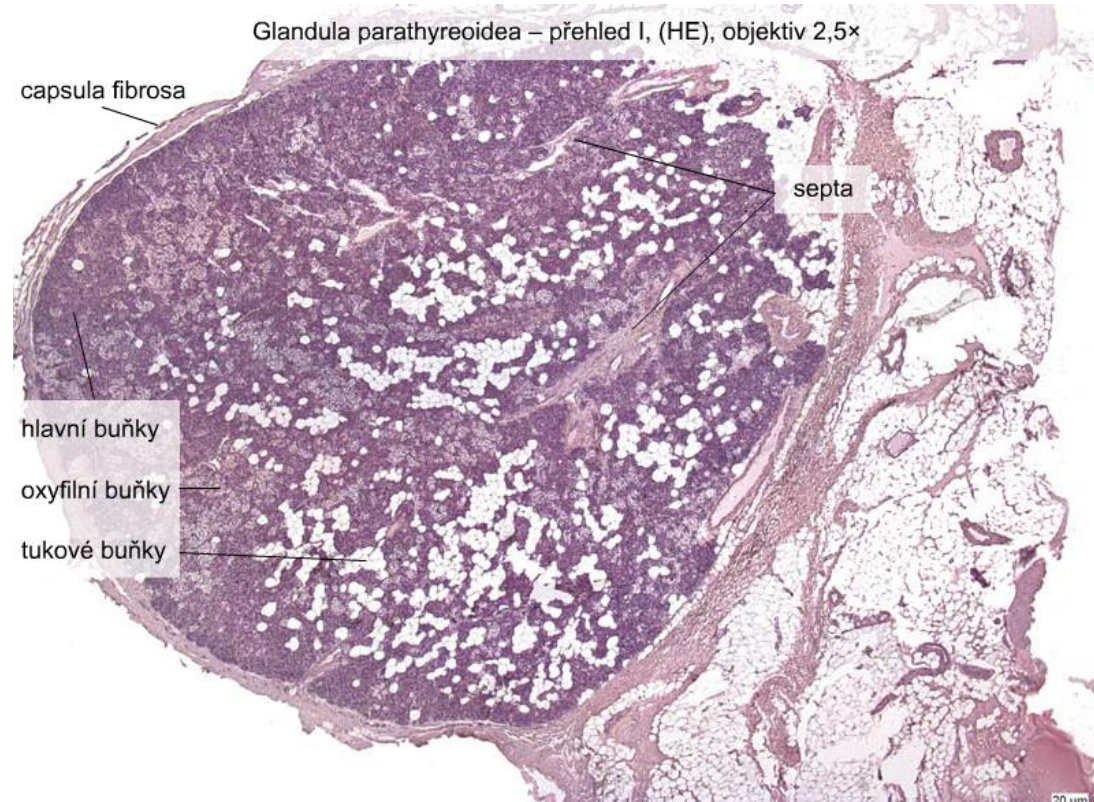
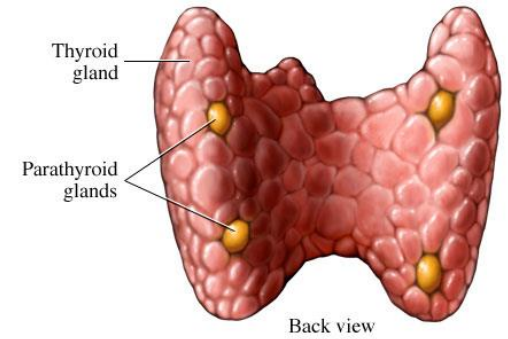
6 mm, 130 mg

Vazivové pouzdro + septa

Kapilární síť

Trámce nebo skupiny žláзовých buněk

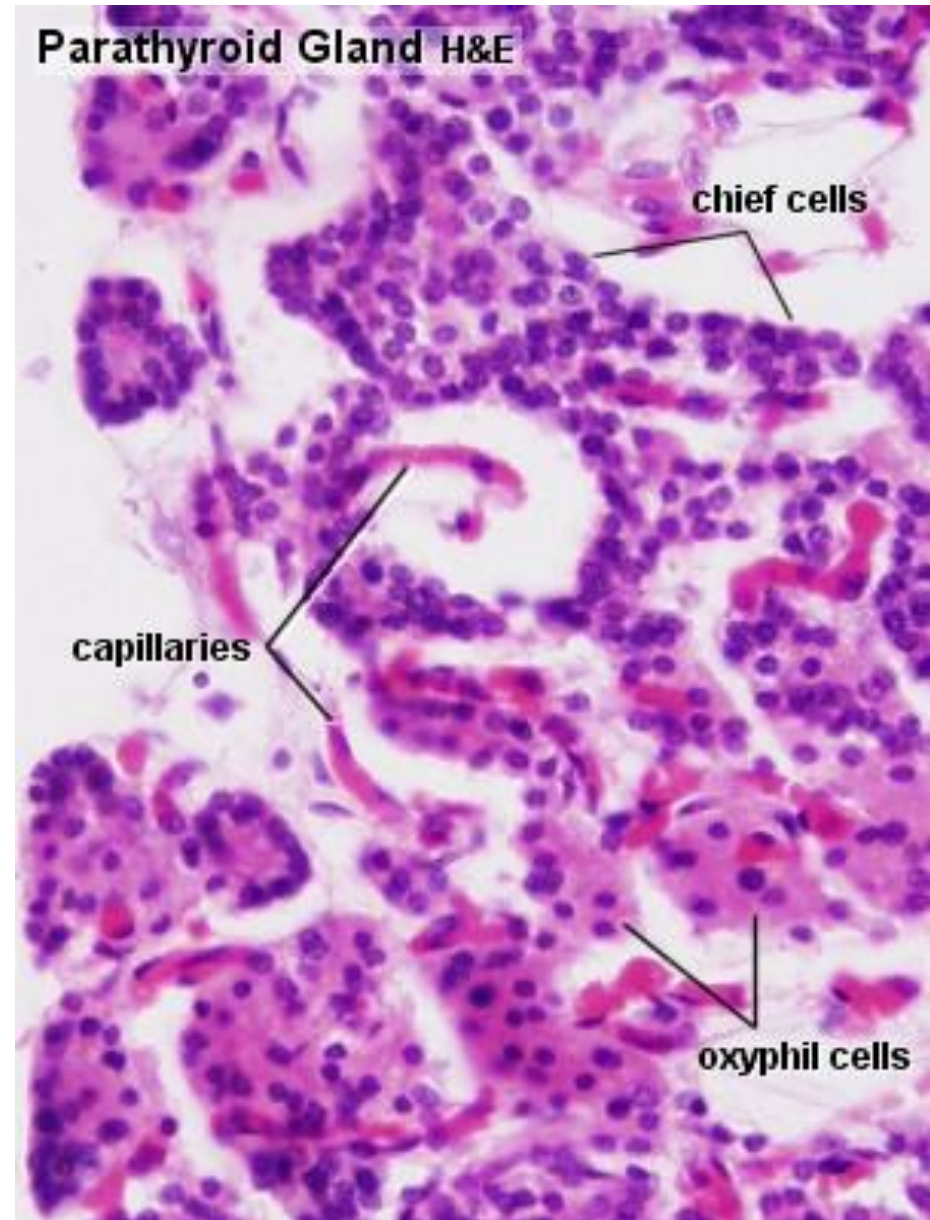
- Hlavní
- Oxyfilní
- Tukové



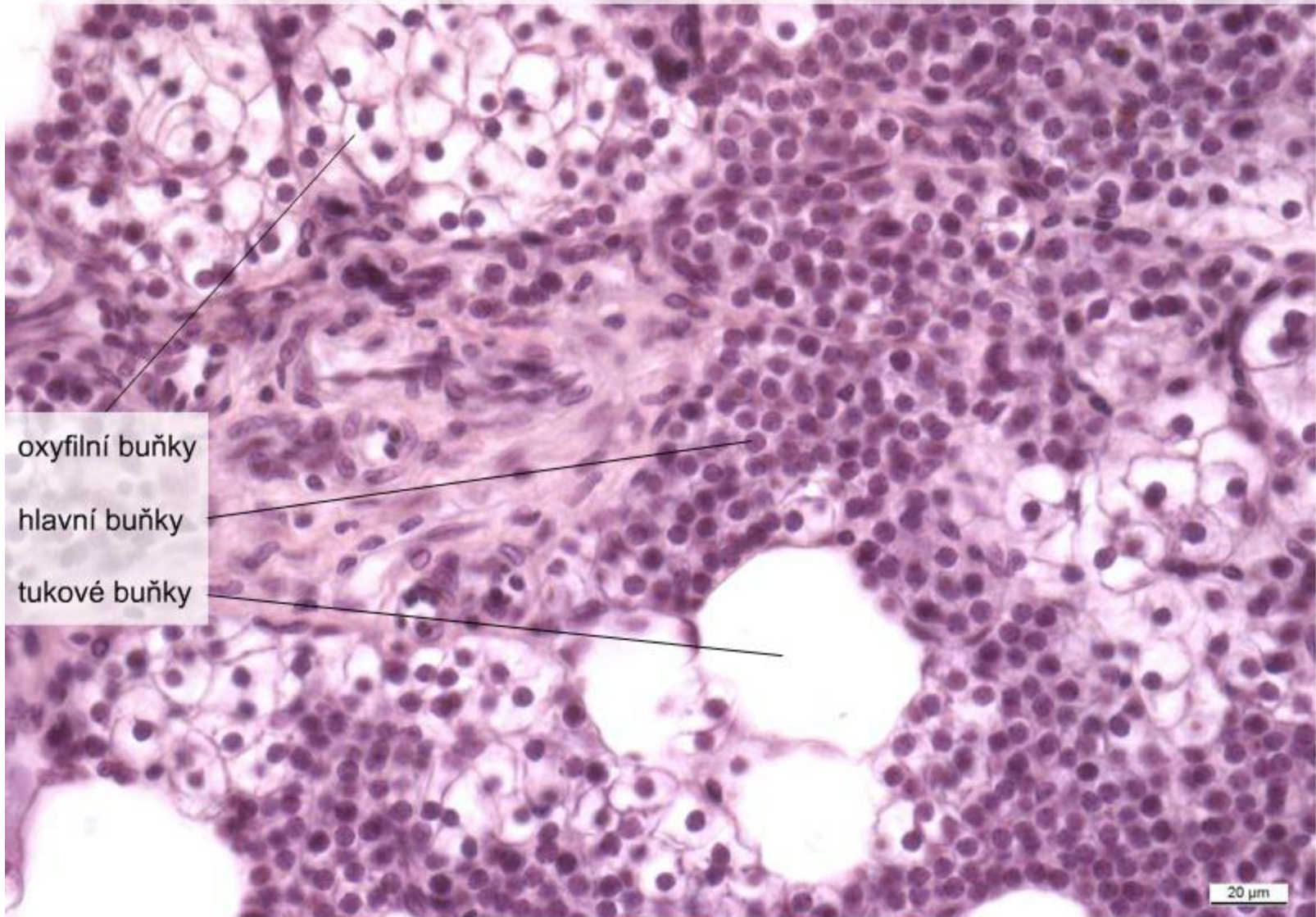
Hlavní buňky

- nejpočetnější
- malé buňky (7-10 μ m) s velkým jádrem
- mírně acidofilní
- PTH – vápníkový metabolismus

- *Oxyfilní*
 - větší, polyedrické,
 - silně acidofilní/eozinofilní
 - kulaté jádro
 - glykogen

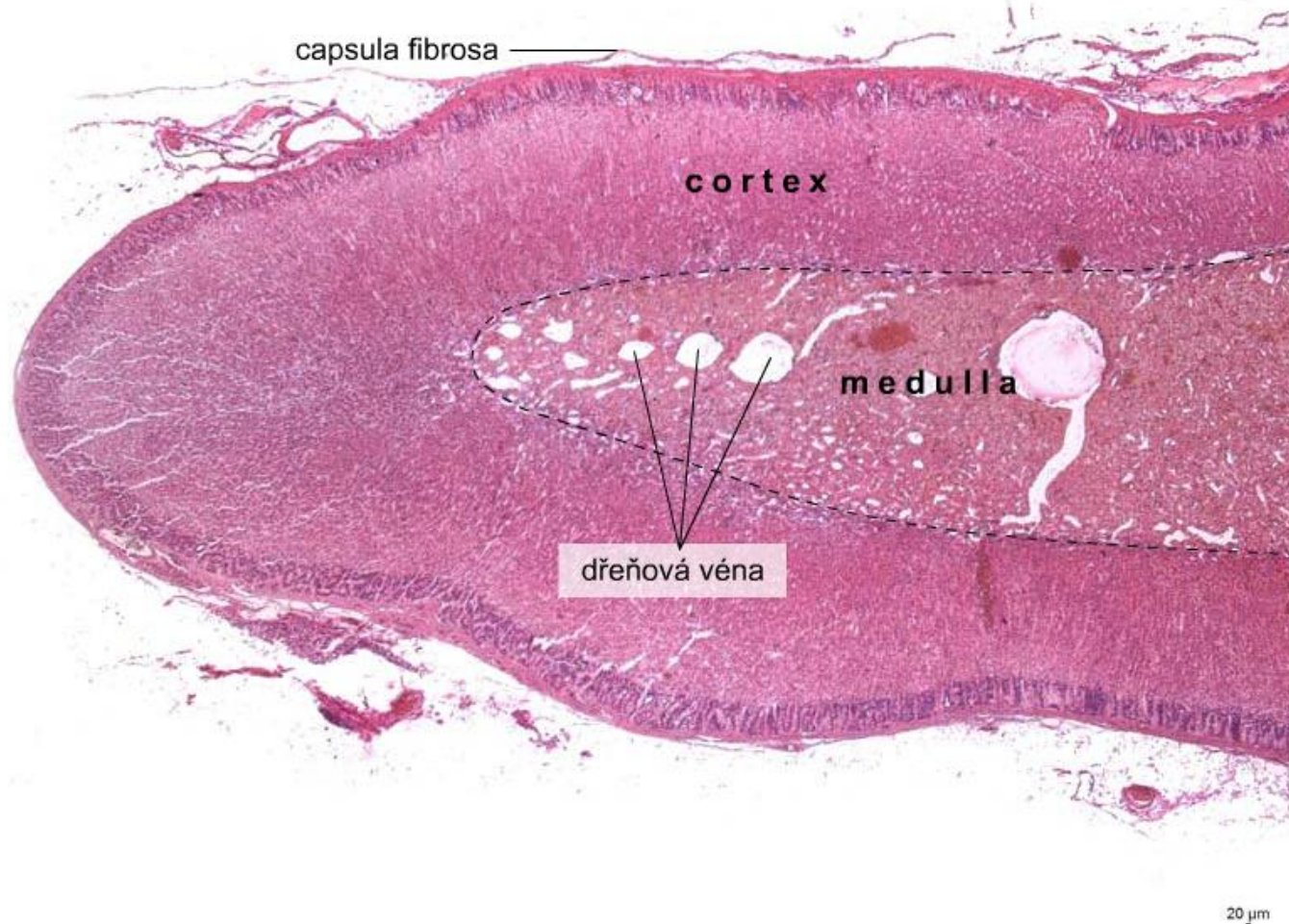


Glandula parathyreoidea – přehled II, (HE), objektiv 40×



Nadledviny

Corpus suprarenale – přehled, (HE), objektiv 2,5x



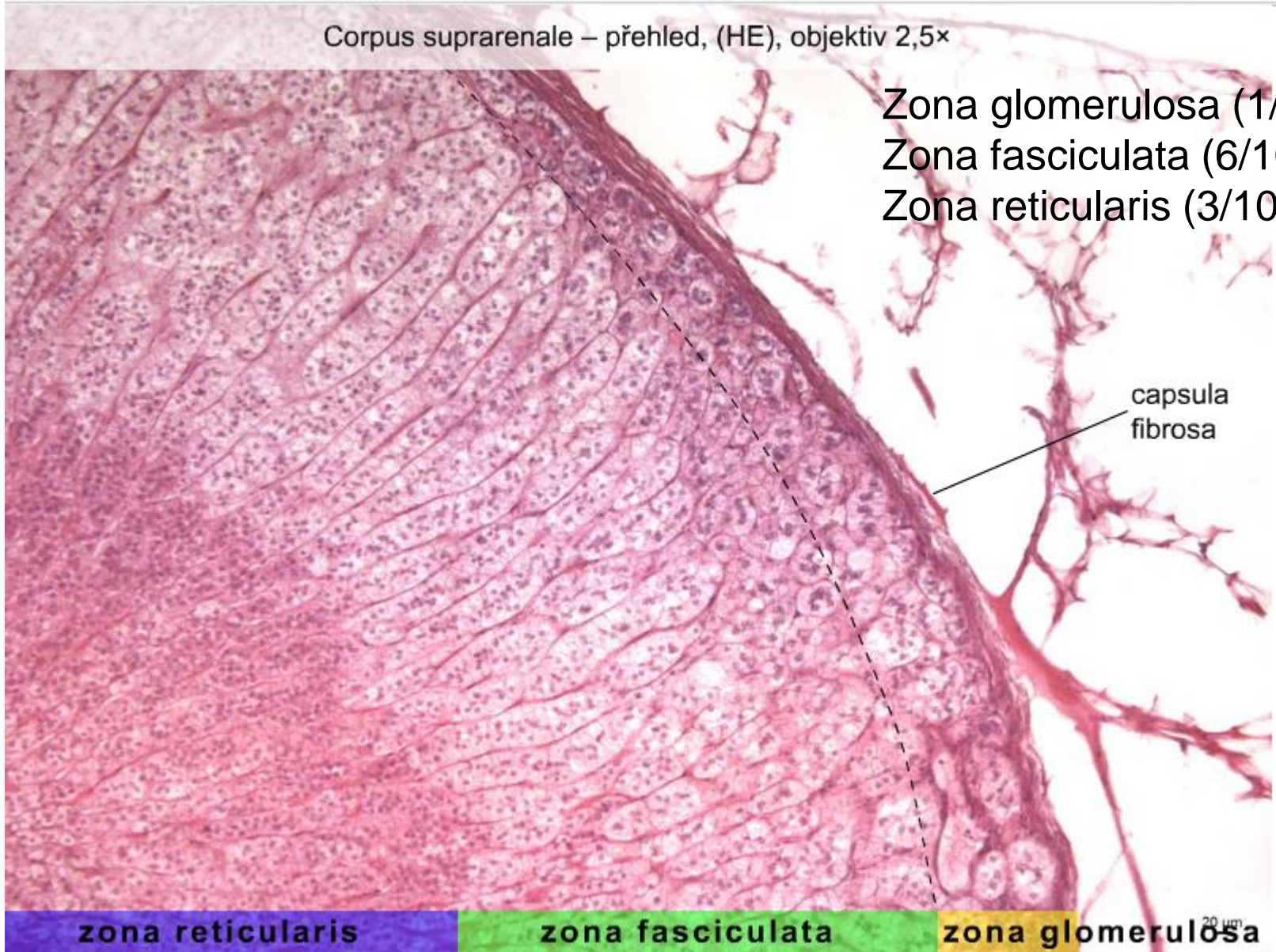
Vazivový obal + septa

Kapilární síť

Různý embryonální původ kůry (coelomový epitel) a dřeně (neuronální lišta - neuroektoderm)

Kůra (Cortex)

Corpus suprenale – přehled, (HE), objektiv 2,5×



Zona glomerulosa (1/10)

Zona fasciculata (6/10)

Zona reticularis (3/10)

capsula
fibrosa

zona reticularis

zona fasciculata

zona glomerulosa

20 μm

Hormony kůry nadledviny

- Steroidy produkované v kortexu = KORTIKOSTEROIDY
- Steroidogenní buňky
 - SER, lipidové kapénky, mitochondrie
 - *mineralokortikoidy*
 - *glukokortikoidy*

Aldosteron – zona glomerulosa

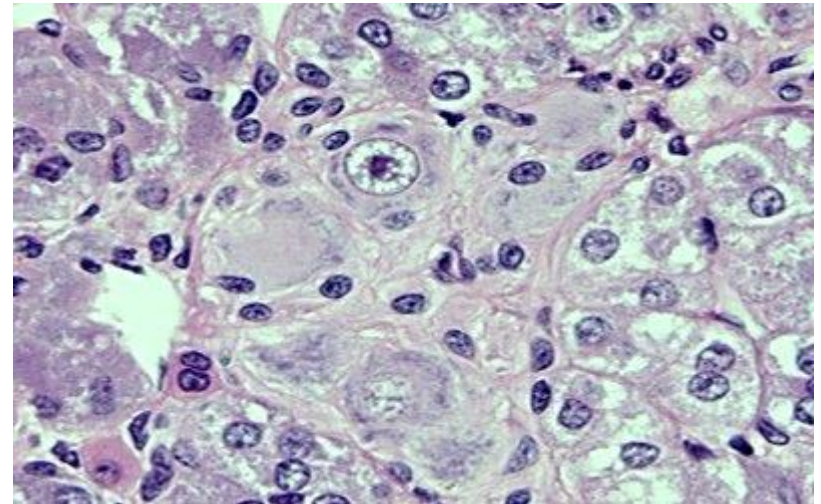
Kortisol – zona fasciculata

Androgeny, estrogeny, progesteron – zona reticularis

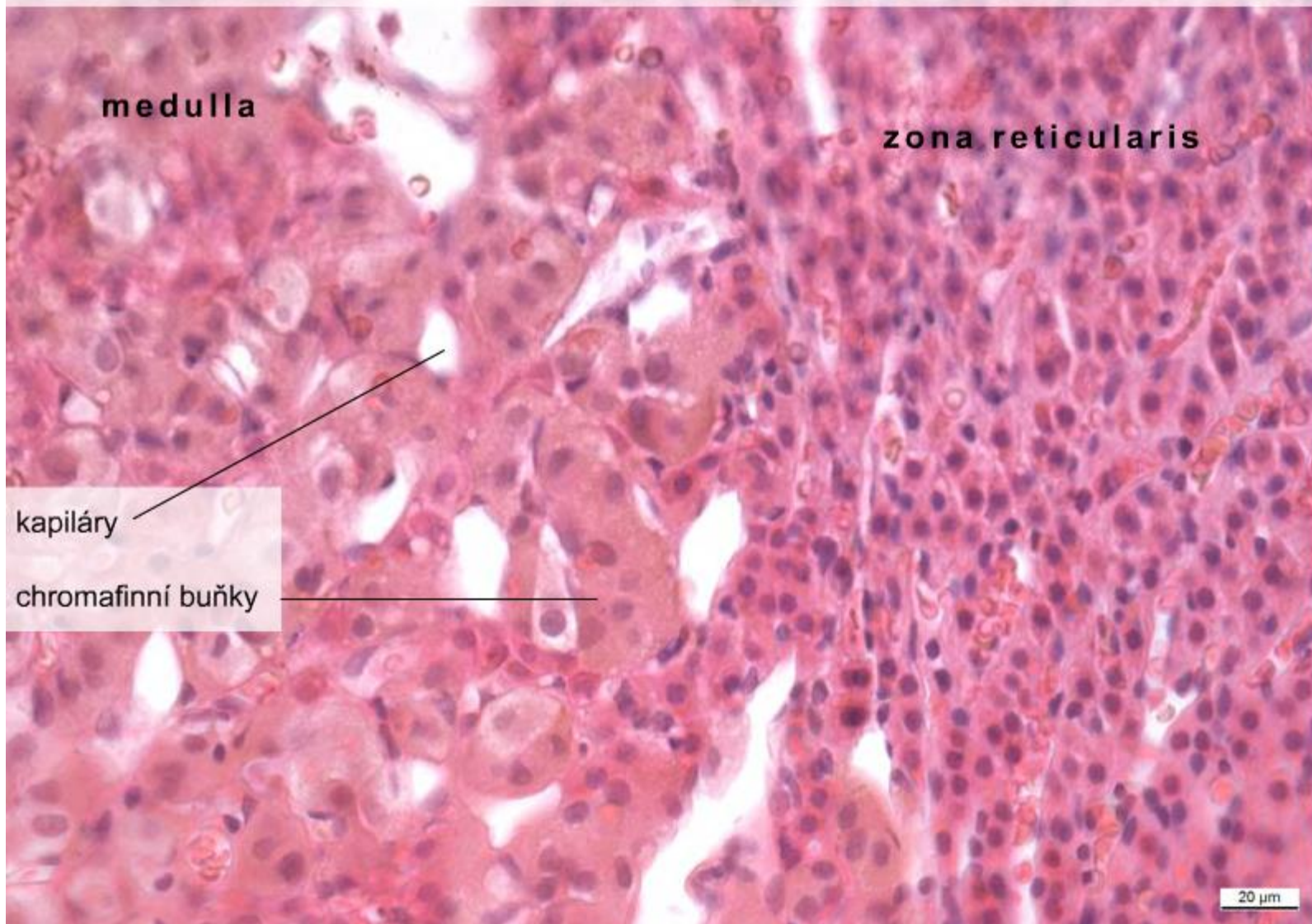
Dřeň nadledviny

Shluky žlázových buněk v retikulárním vazivu

- chromafinní buňky – modifikované postgangliové neurony
 - gangliové buňky
 - kapiláry, venuly, nervová vlákna
-
- adrenalin a noradrenalin



Corpus suprarenale – medulla, (HE), objektiv 40×



medulla

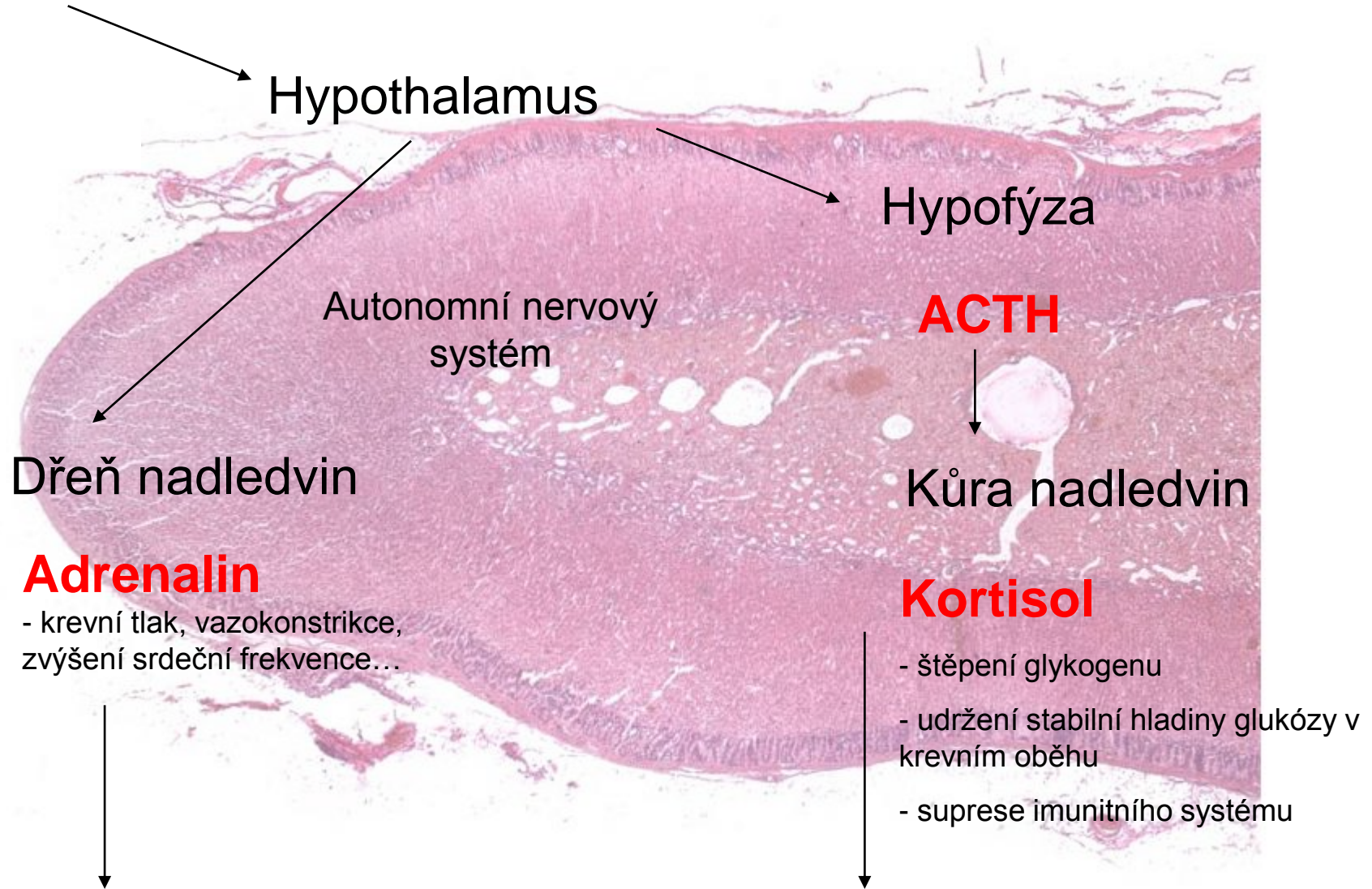
zona reticularis

kapiláry

chromafinní buňky

20 μm

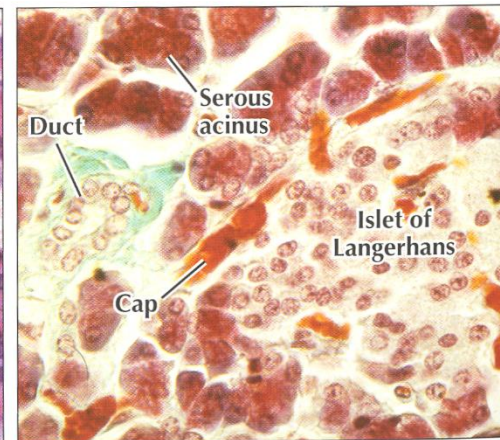
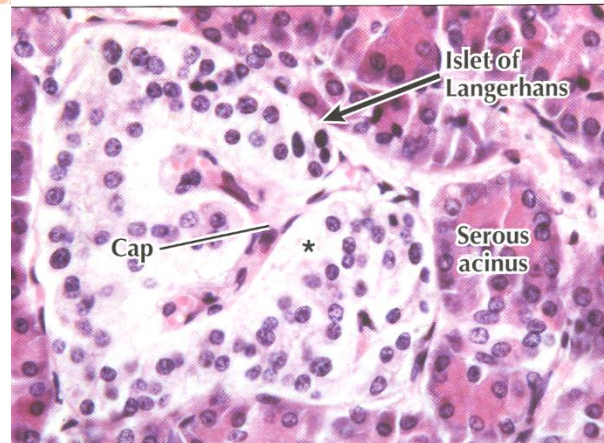
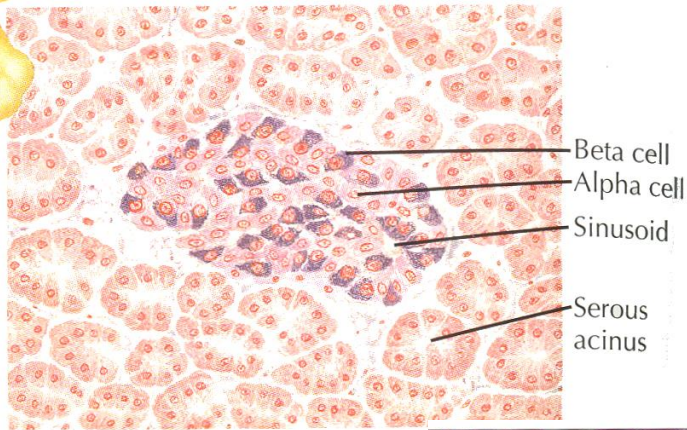
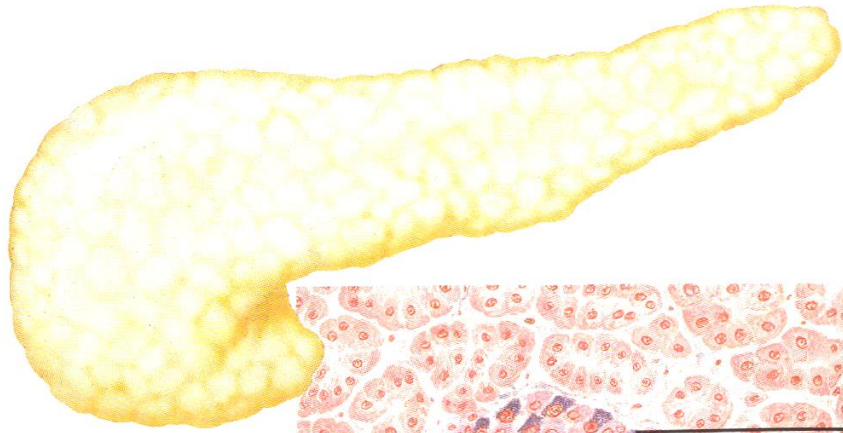
Stres



Fight or Flight

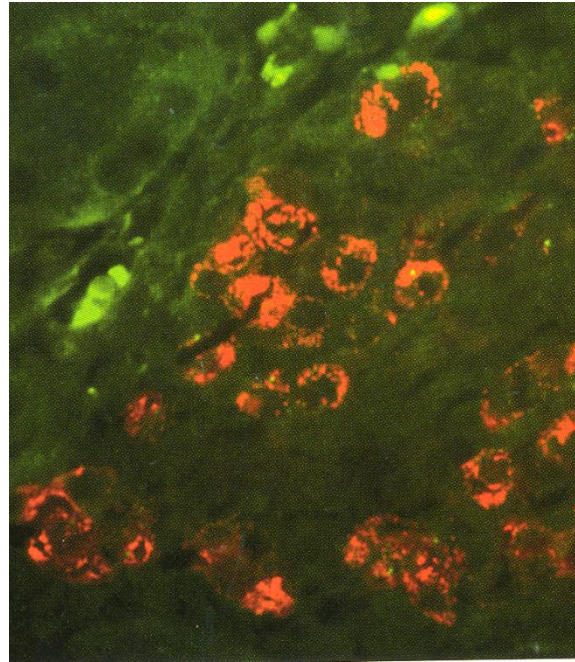
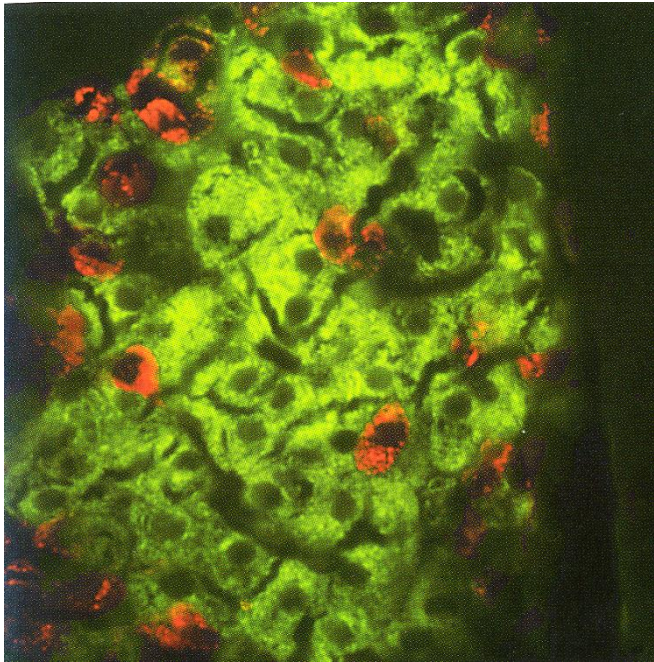
Adaptace, regenerace

Langerhansovy ostrůvky pankreatu



Langerhansovy ostrůvky pankreatu

A diabetes typu I



B-buňky produkující inzulin



Ab-anti insulin –Alexa Fluor

A-buňky produkující glukagon



Ab-anti glukagon –Texas Red

Preparáty

- 52. Hypophysis cerebri
- 53. Epiphysis
- 54. Glandula thyreoidea
- 55. Glandula parathyroidea
- 56. Corpus suprarenale
- 23. Pankreas – Langerhansovy ostrůvky