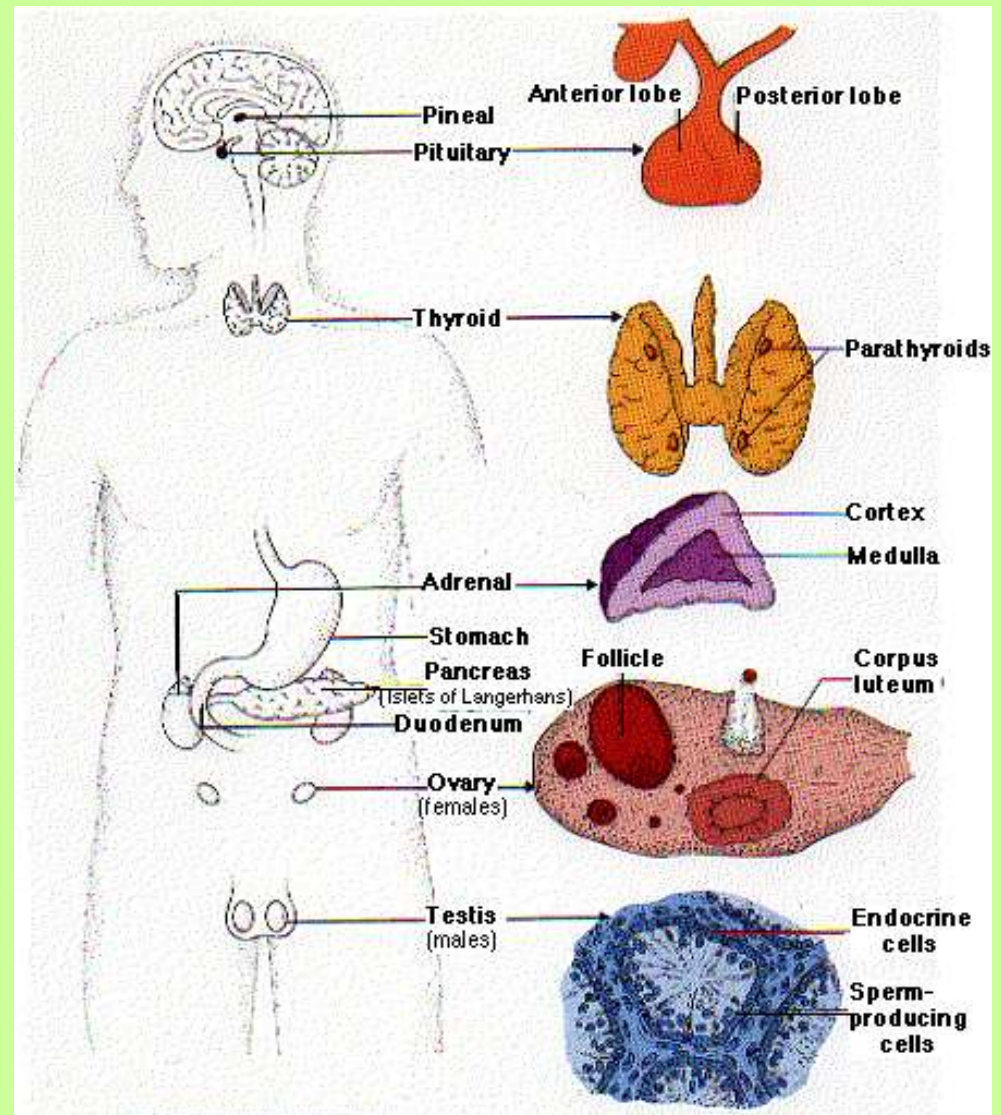


Endocrine system

- system of glands and groups of cells
- maintenance of homeostasis
- slower and more diffuse response than nervous system



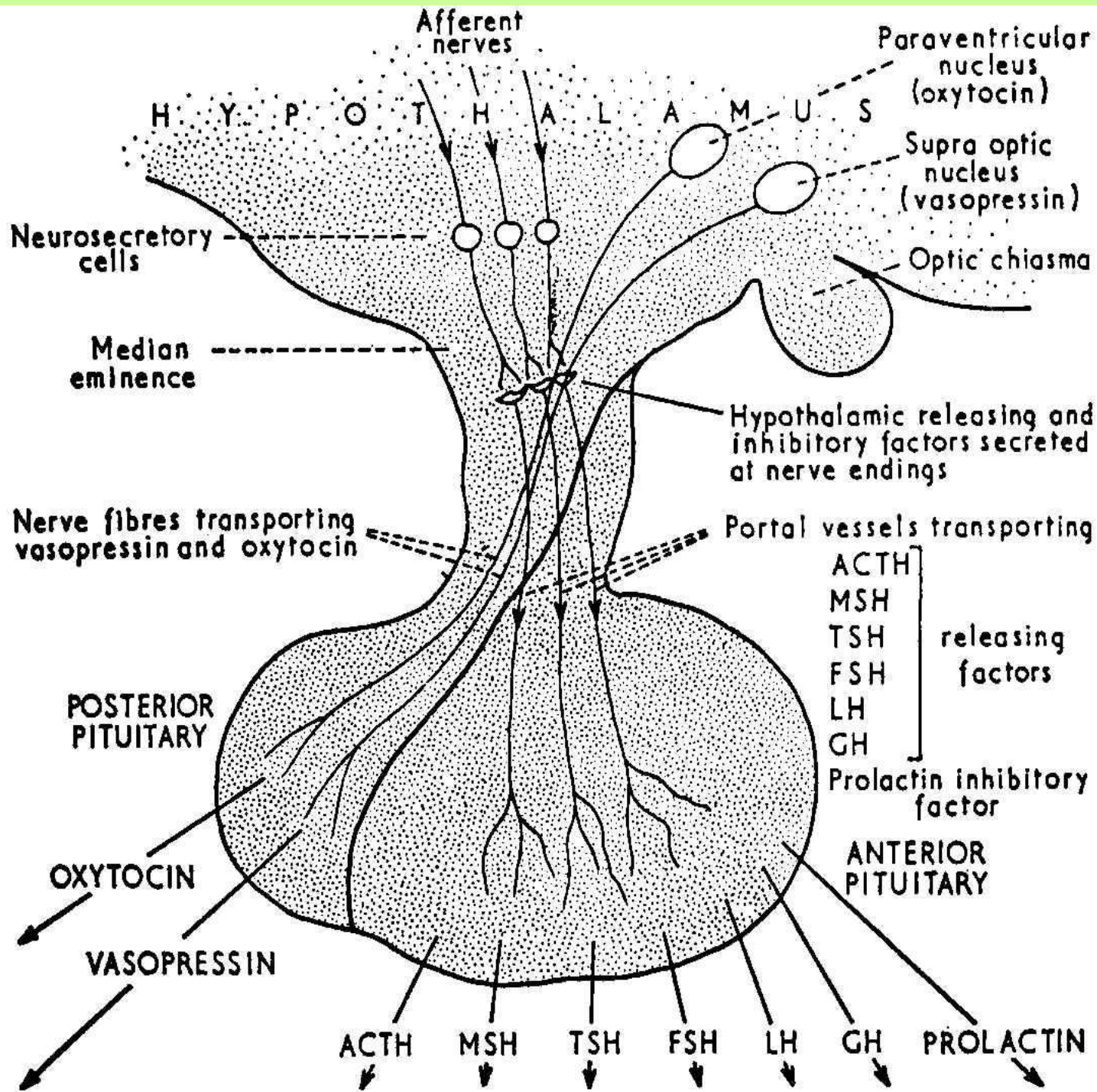
• Hormeo = to stir up, influence

Endocrine glands

- no ducts, richly supplied by blood vessels
- pour (secret) their secretions (hormones) directly into blood stream

- **thyroid gland**
- **parathyroid gland**
- **adrenal (suprarenal) gland**
- islets of Langerhans of pancreas
- pineal gland (epiphysis)
- hypophysis (pituitary gland)
- ovary, testis

gastroenteroendocrine cells , kidney cells,
thymus, placenta, heart, adipous tissue, brain...



Hormonal excess

- primary gland overproduction
- secondary to excess production of trophic (releasing, stimulating) substance (hormone)

Hormonal deficiency

- primary gland failure
- secondary to lack of stimulation by trophic (releasing, stimulating) substance (hormone)
- target organ resistance

Thyroid gland– štítná žláza

H shape (2 lobes, narrow isthmus)

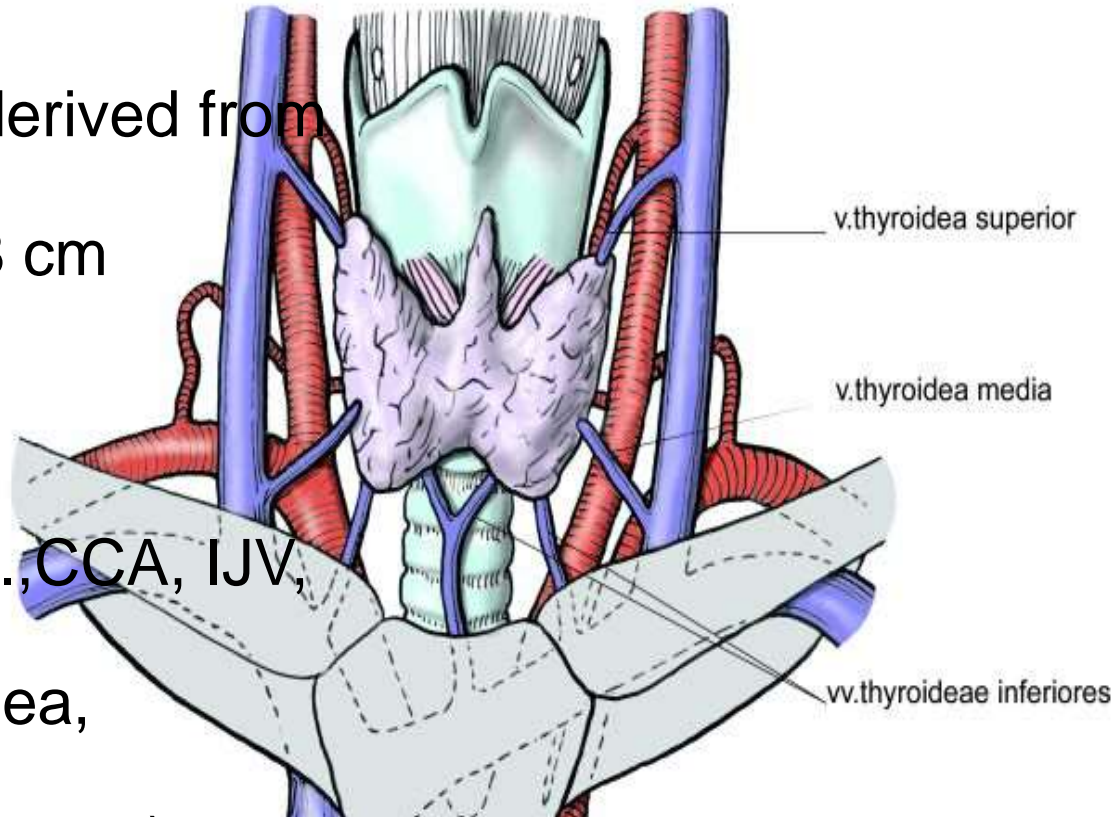
- isthmus – level of 2-4 tracheal ring
- pyramidal lobe
- surrounded by sheath derived from pretracheal
- pear shaped lobes, 5-8 cm
- 30-40 g (20-60g)

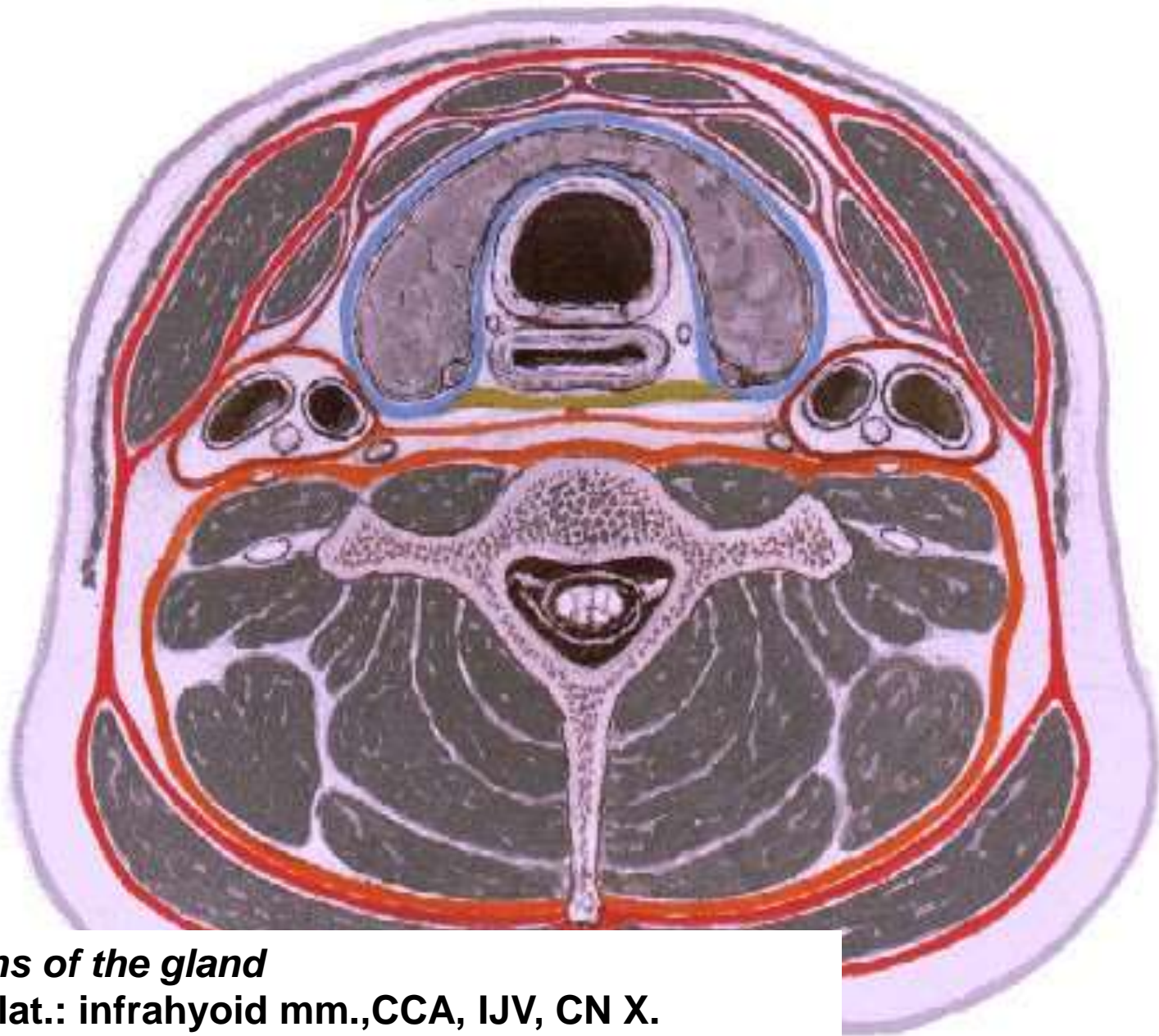
• *Relations of the gland*

posterolat.: infrahyoid mm., CCA, IJV, CN X.

posteromed.: larynx, trachea, pharynx, esophagus

caud.: manubrium sterni (rarely)





Relations of the gland

posterolat.: infrahyoid mm., CCA, IJV, CN X.

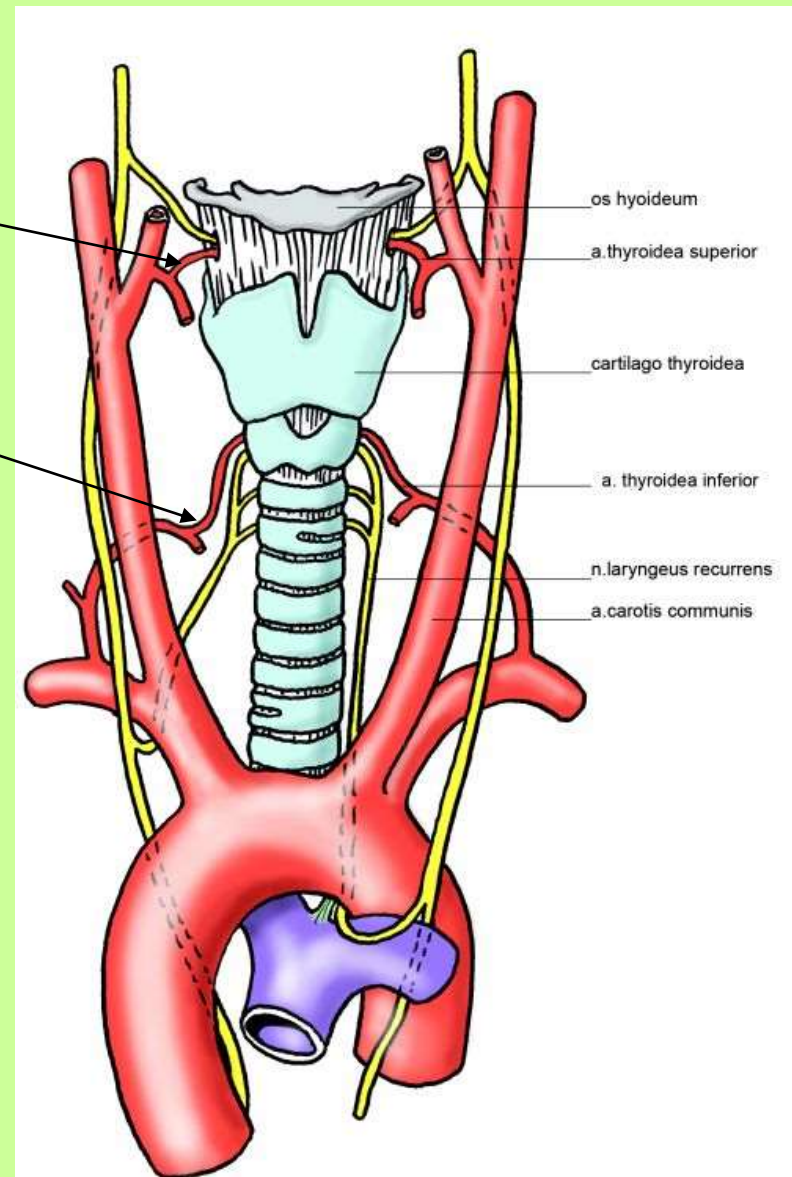
posteromed.: larynx, trachea, pharynx, esophagus

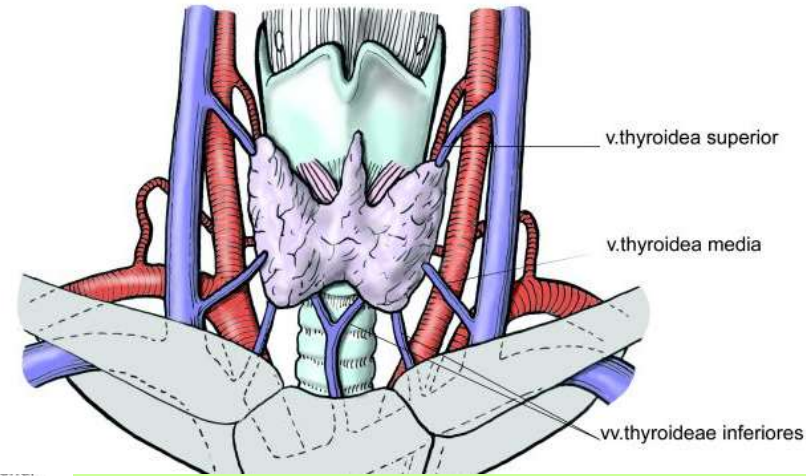
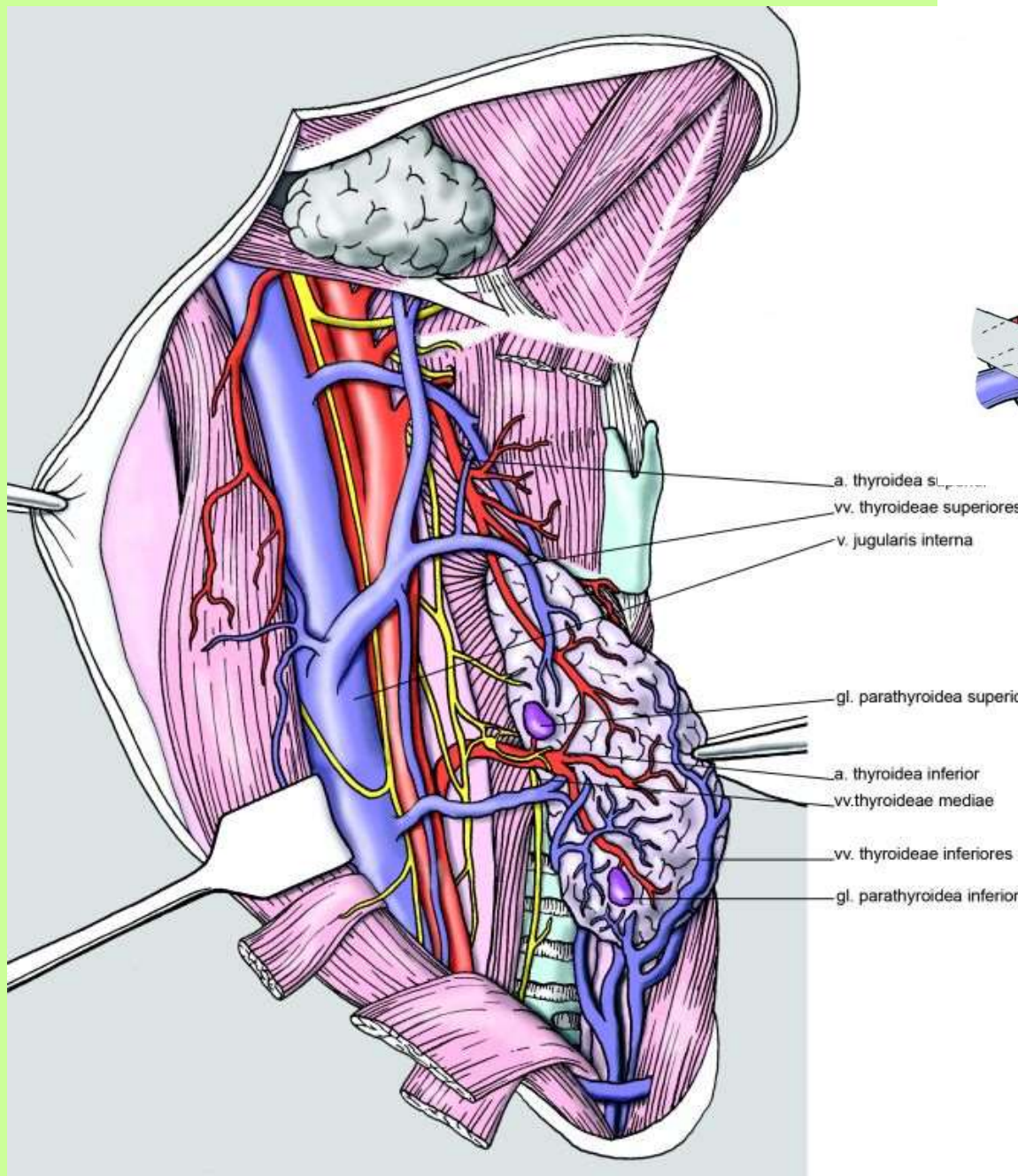
ant.: infrahyoid mm.

Blood supply of thyroid

Arteries

- superior thyroid a. (from external carotid a.)
- inferior thyroid a. (from subclavian a.)
- thyroidea ima

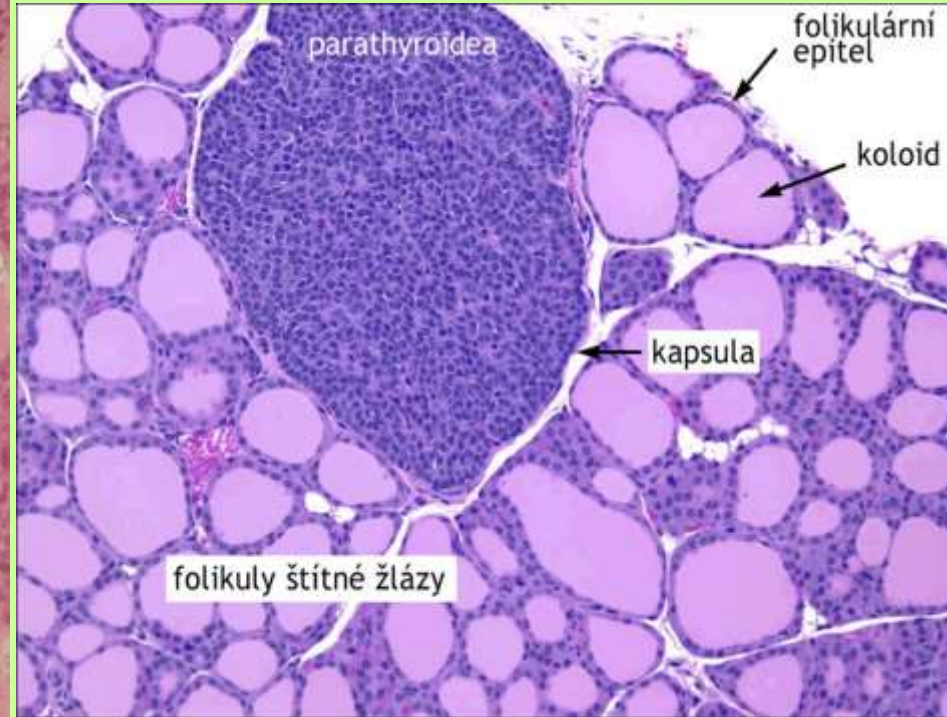
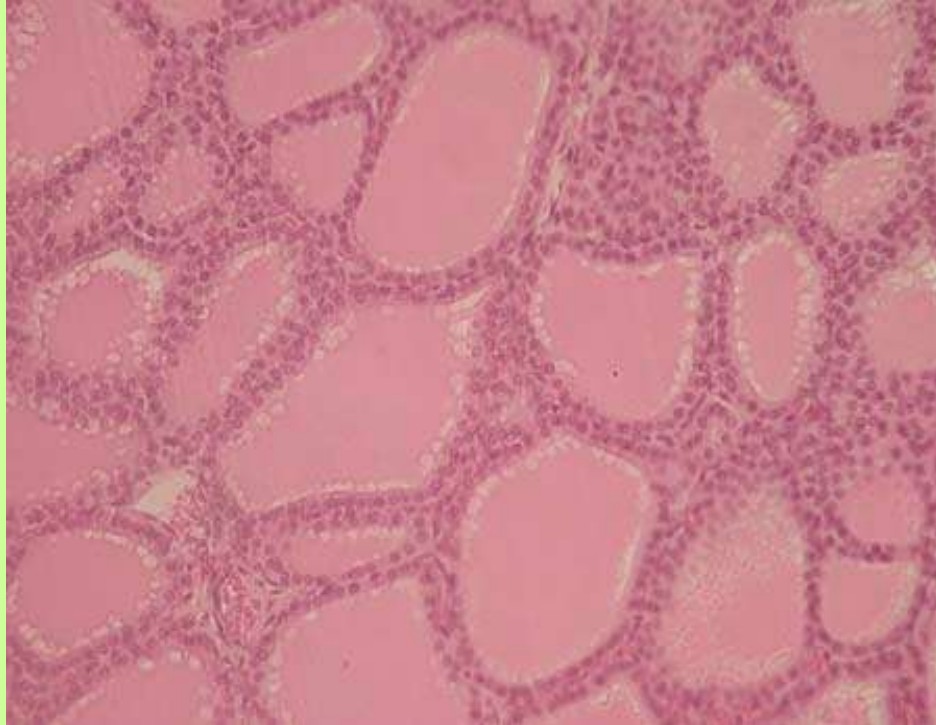




Veins

- superior et middle thyroid vv. (> IJV)
- inferior thyroid vv. (impaired thyroid plexus) (> brachiocephalic vv).

thyroid gland



- thyroid follicle (**follicular cells**)
- cavity of the thyroid follicle, filled with colloid
- blood vessel
- **parafollicular cells**

follicular cells

- **trijodthyronine T3, tetrajodthyronine T4 (thyroxine)**
- thyroglobulin in follicles (storage protein)
- thyroxine –binding globulin (TBG) in plasma (carrier protein)
- under control of **TSH**
- increases basal metabolic rate (heat generation....)
- essential to proper development and differentiation of all cells of the human body incl. neurons (- cretinism)

Cretinism is a condition of severely stunted physical and mental growth due to untreated congenital deficiency of thyroid hormones or from prolonged nutritional deficiency of iodine (Endemic cretinism was especially common in areas of southern Europe around the Alps from Roman times till 20th cent.)

parafollicular cells (C – cells)

- **Calcitonin**
- reduces blood calcium (Ca^{2+}) (opposing the effects of parathyroid hormone - PTH).
 - Inhibits Ca^{2+} absorption by the intestines
 - Inhibits osteoclast activity in bones
 - Inhibits Ca^{2+} reabsorption by the kidney tubules

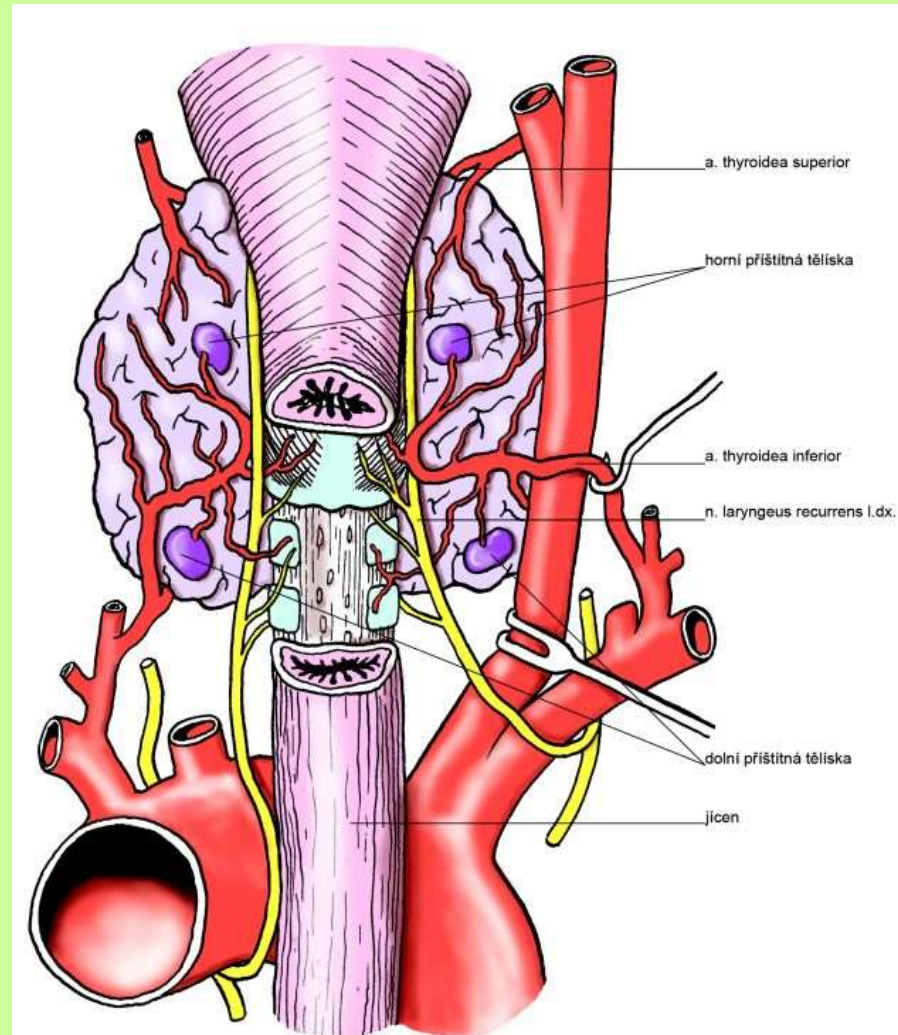
- **Hypothyroidism x Hyperthyroidism**

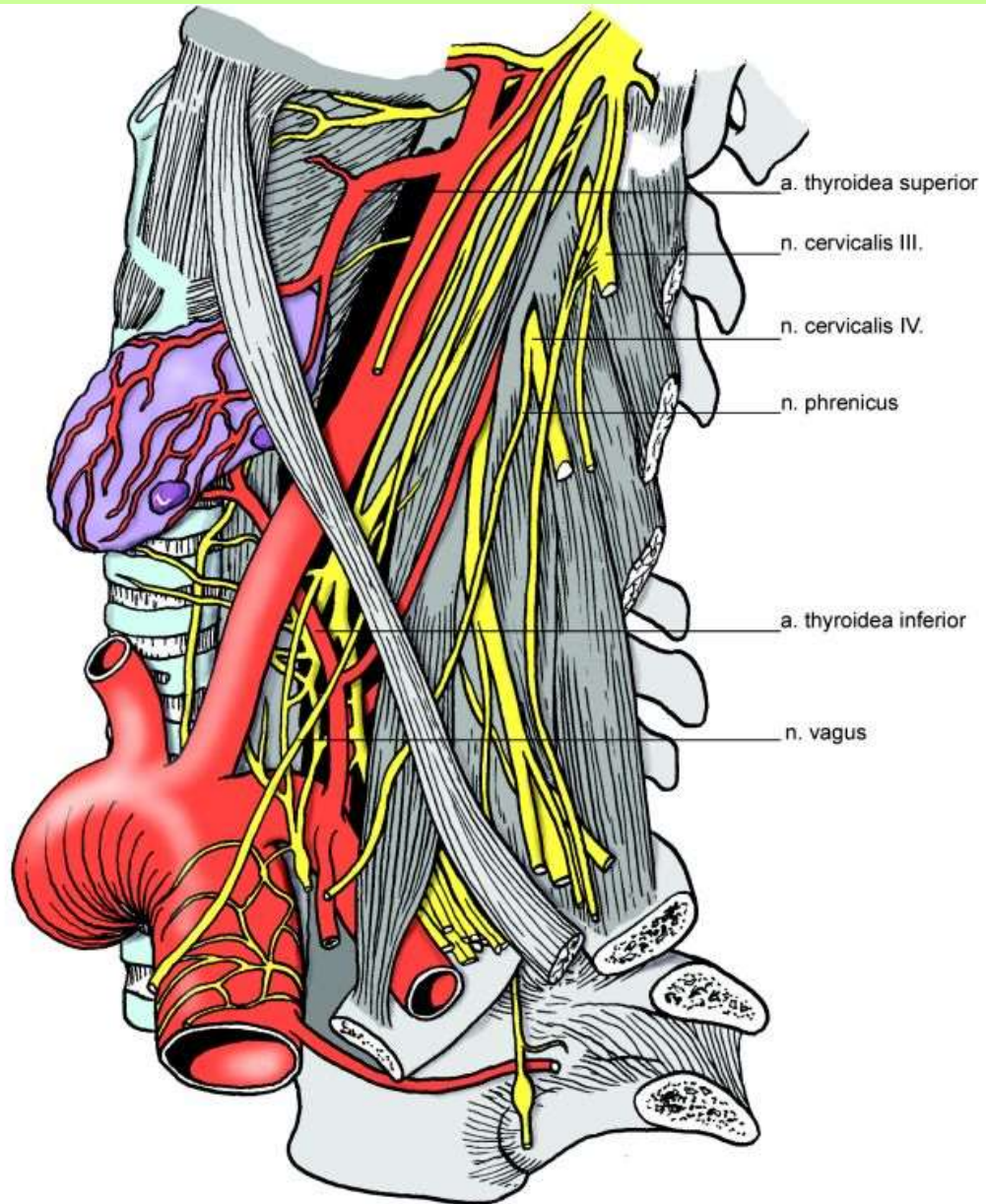
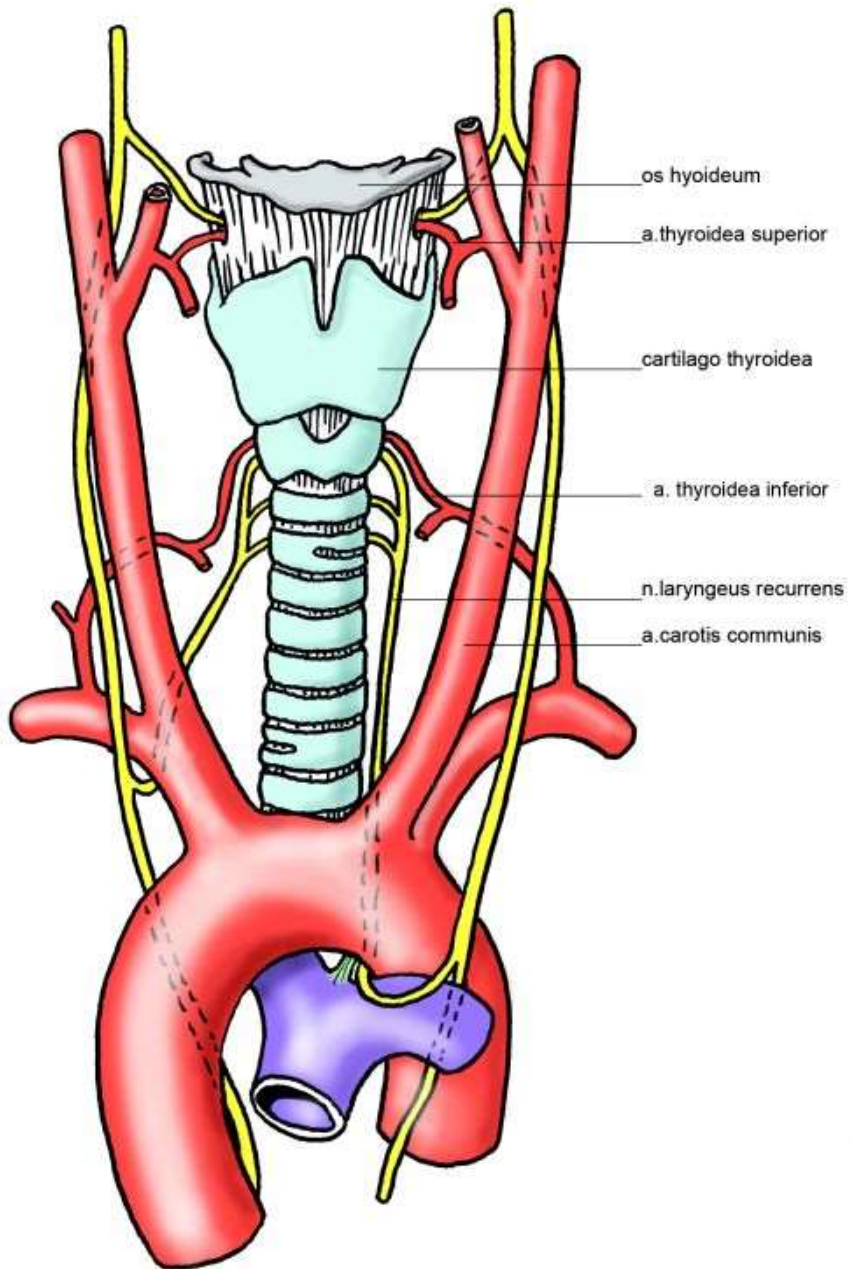
- Goitre
- Cretinism



Parathyroid gland - příštitná tělíska

- usually **2 pairs** of small glands located on the posterior surface (back side) of thyroid gland (4x2 mm)
- superior et inferior parathyroid gland
- At close relationship to laryngeus recurrens and inferior thyroid a.



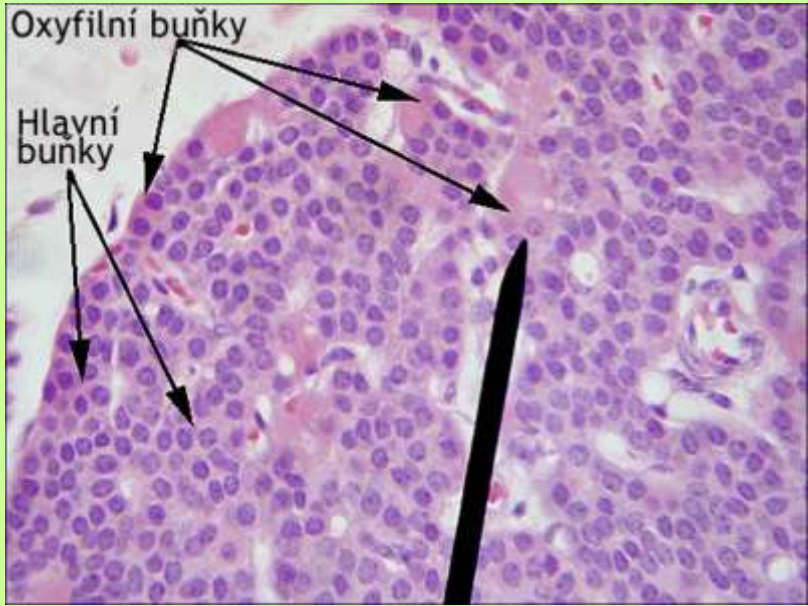
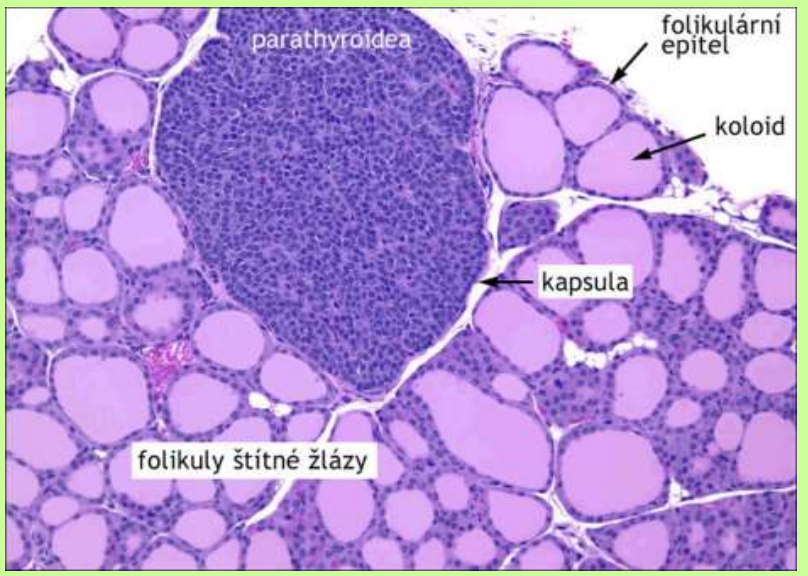


- **Parathormone (PTH)**
- increases blood calcium (Ca^{2+}) (opposing the effects of calcitonin).

- increases Ca^{2+} absorption by the intestines
- stimulates osteoclast activity in bones
- increases Ca^{2+} reabsorption by the kidney tubules

Hypoparathyroidism

Hyperparathyroidism

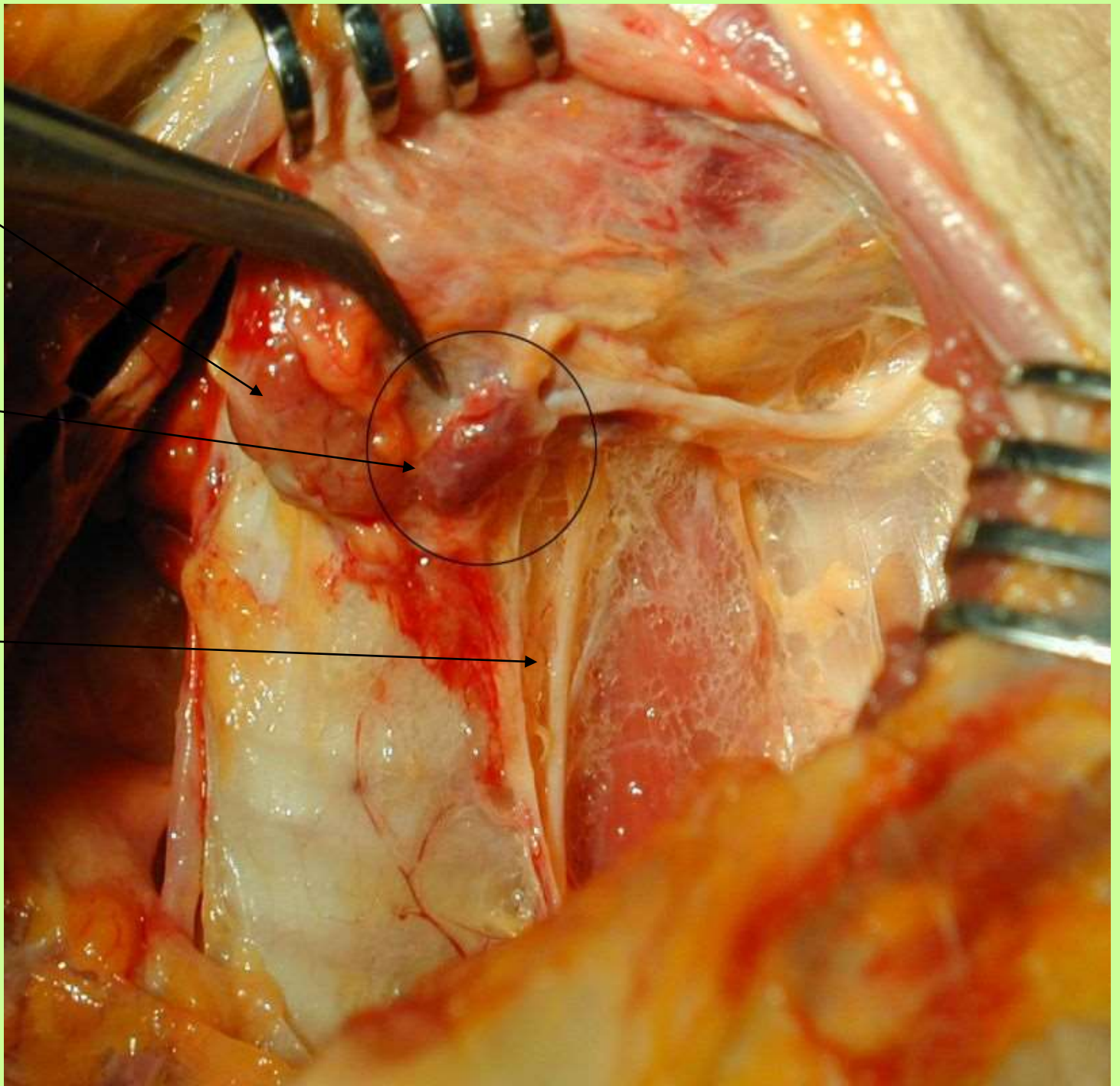


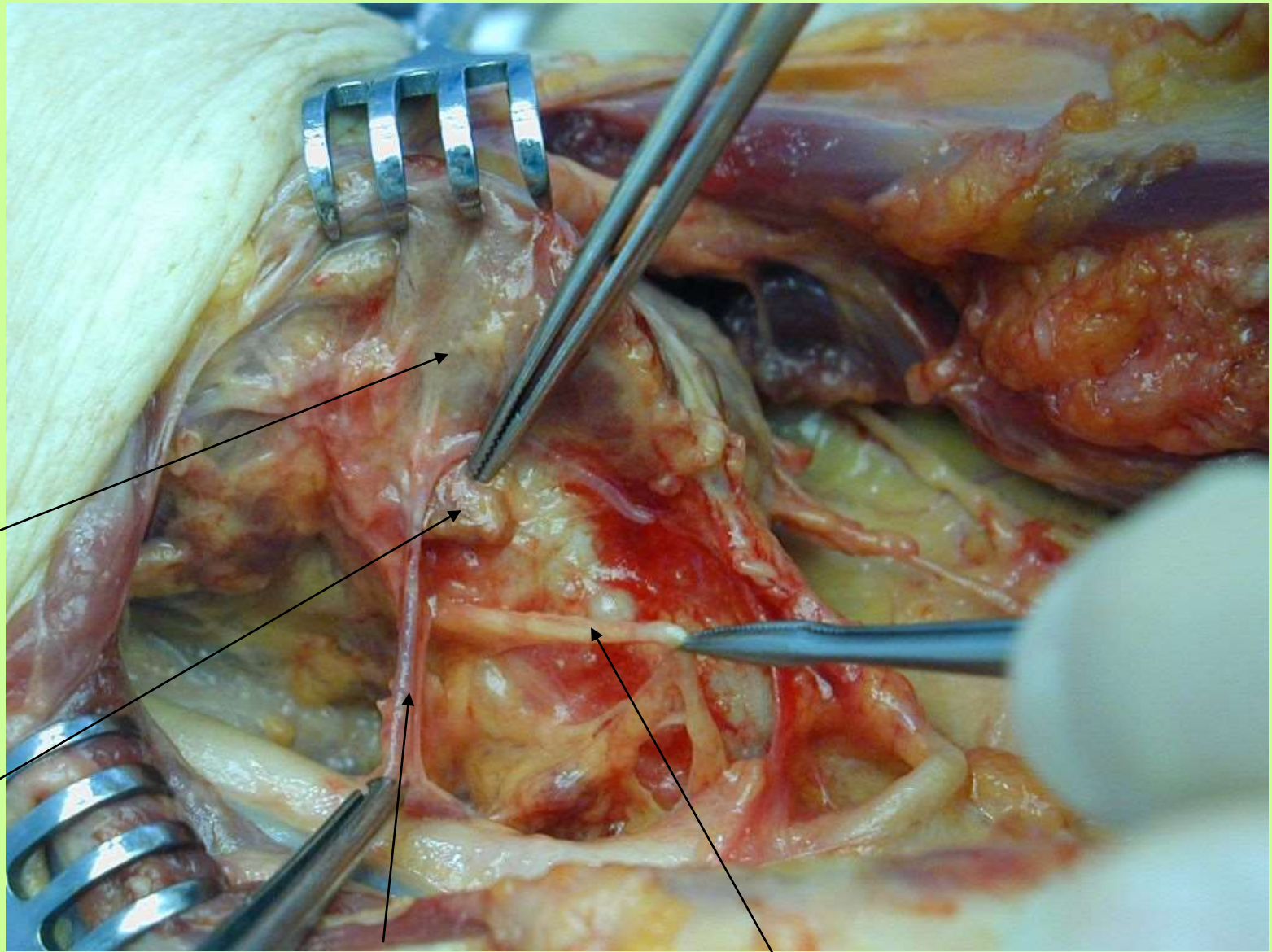
parathyroid chief cell
oxyphil cells

th.gland

parath.gland

reccurent
laryngeal n.





Th.gland

Parath.
gland

inferior th. a.

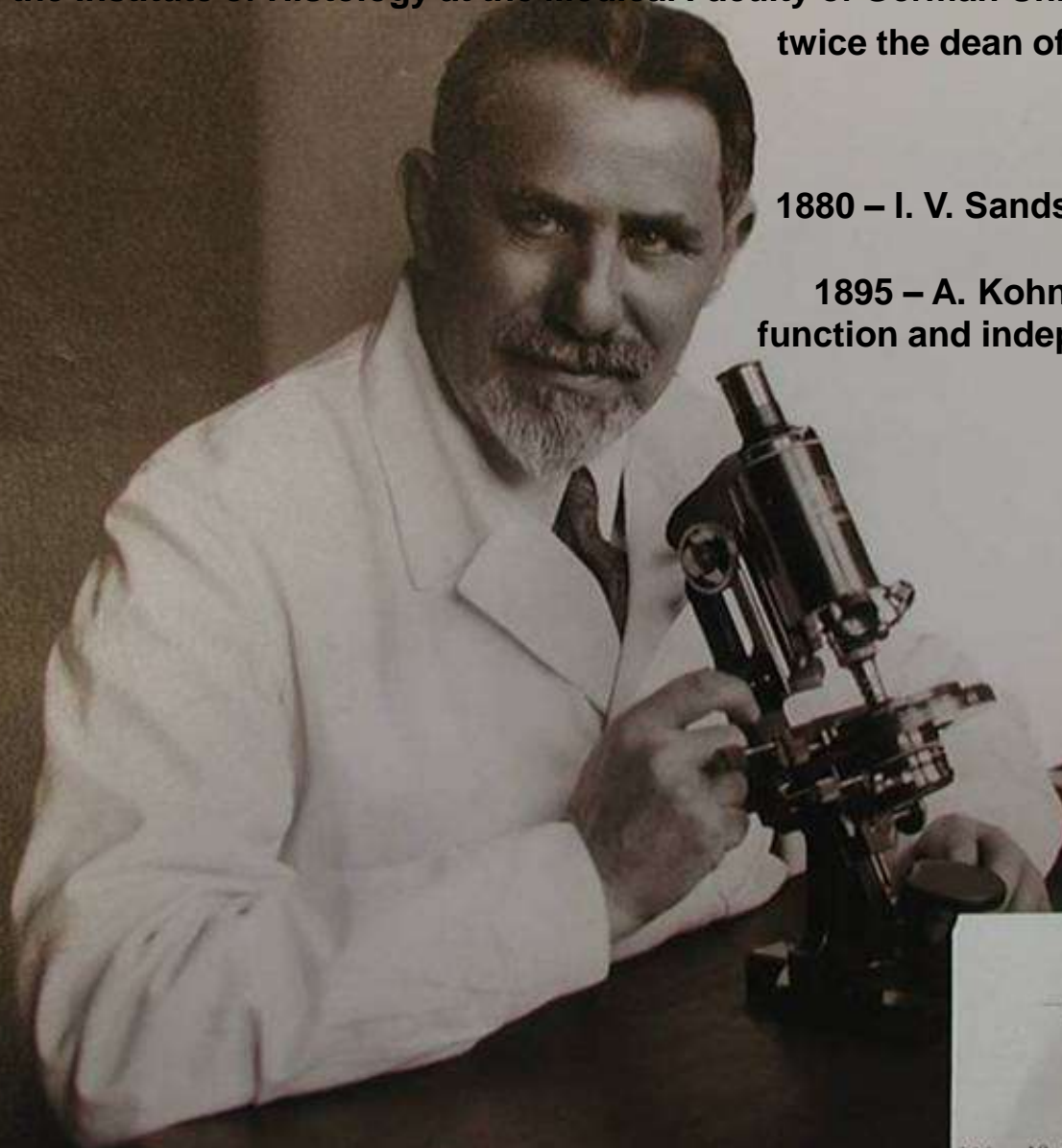
reccurent laryngeal n.

Alfred Kohn (1867–1959)

head of the Institute of Histology at the Medical Faculty of German University in Prague for 26 years.
twice the dean of German Medical Faculty in Prague

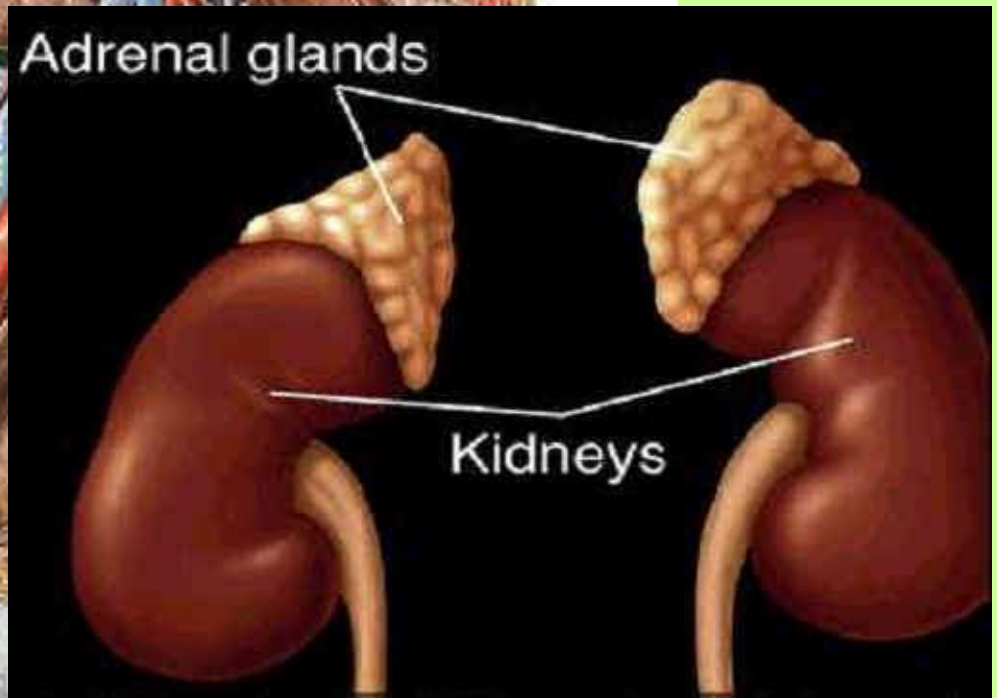
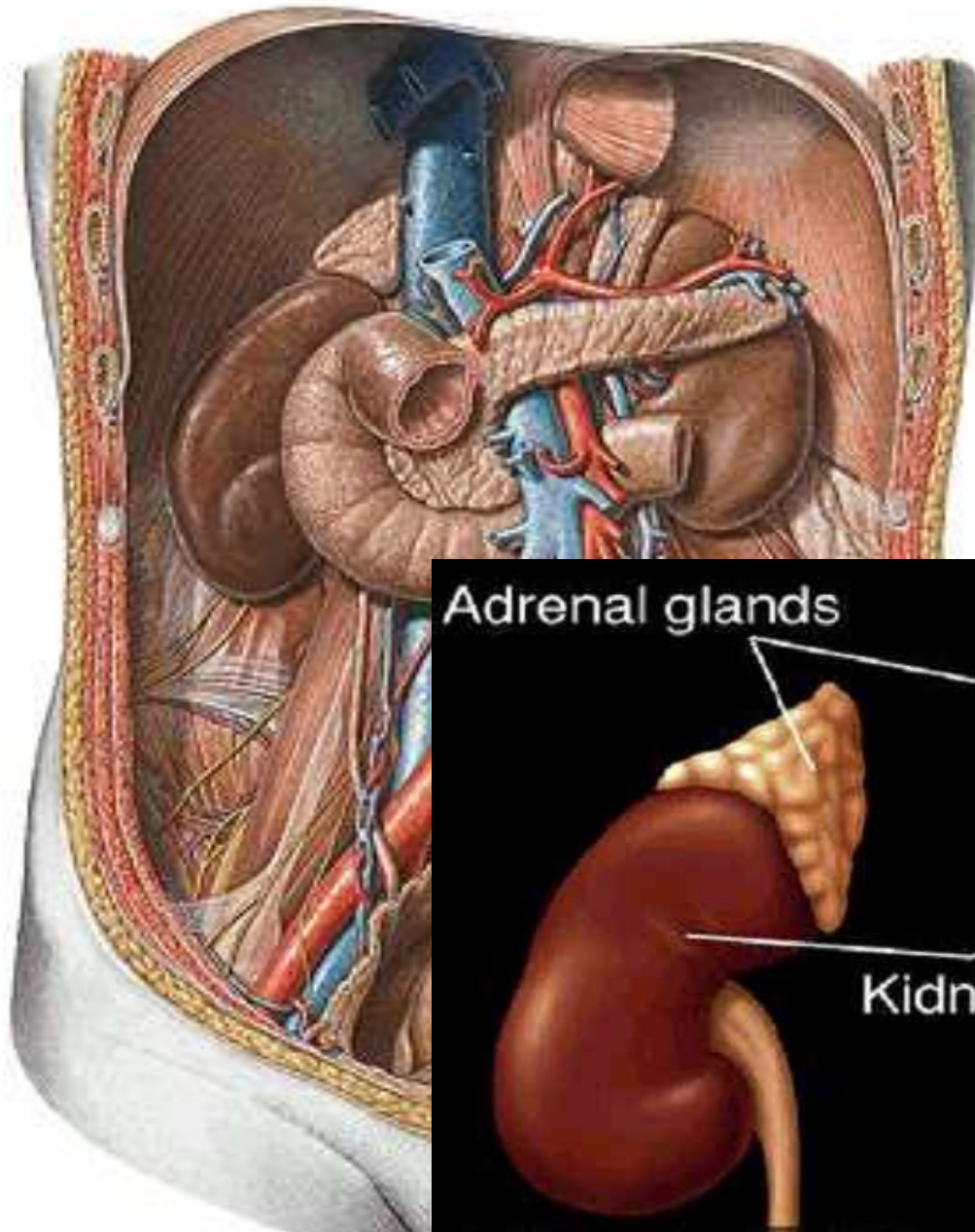
1880 – I. V. Sandström – described gl. parathyroidea

1895 – A. Kohn – demonstrated its independent function and independent developmental origin (1898)



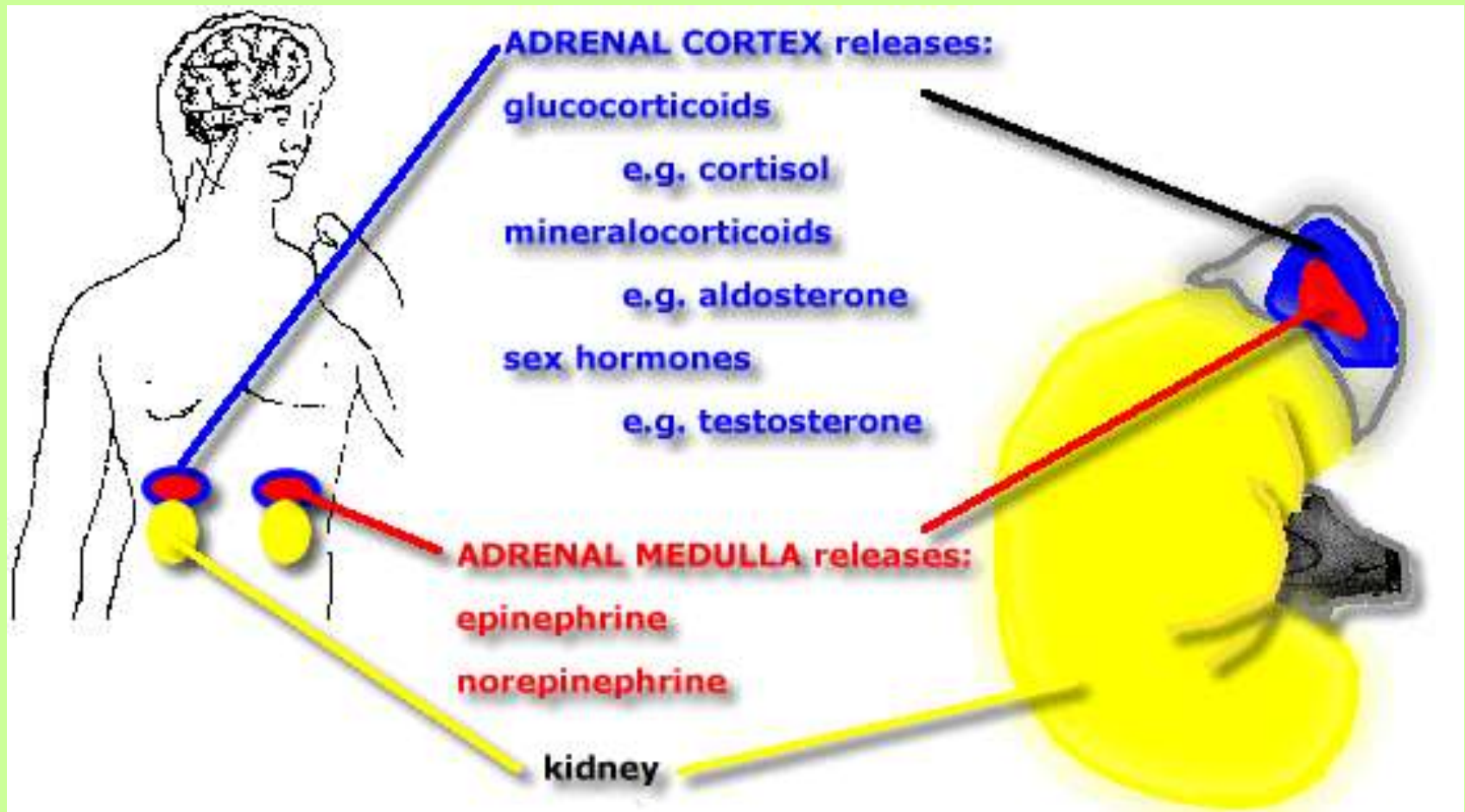
Prof. Dr. Alfred Kohn
Unterschrift des Haushaltsvorstandes.
Podpis přednosty domácnosti.
Bitte wenden! — Prosim obratit!
000 - 10. X. 1942. - Politika.

Adrenal (suprarenal) glands -nadledviny



Adrenal (suprarenal) glands

- level Th 11-12 , 6-12g
- Medulla – catecholamine hormones (adrenaline, noradrenaline), dopamine
- Cortex – 3 zones – 3 distinct groups of hormones
 - Zona glomerulosa - **mineralocorticoids** (aldosterone) –Na/K homeostasis (secretion of K, conservation of Na – increased water retention and blood pressure; renin-angiotensin system)
 - Zona fasciculata – **glucocorticoids** (cortisol)- counteracts insulin, weakens immunity, lowers bone formation...
 - Zona reticularis – **androgens** (dehydroepiandrosteron-DHEA) – prohormone of sex steroids



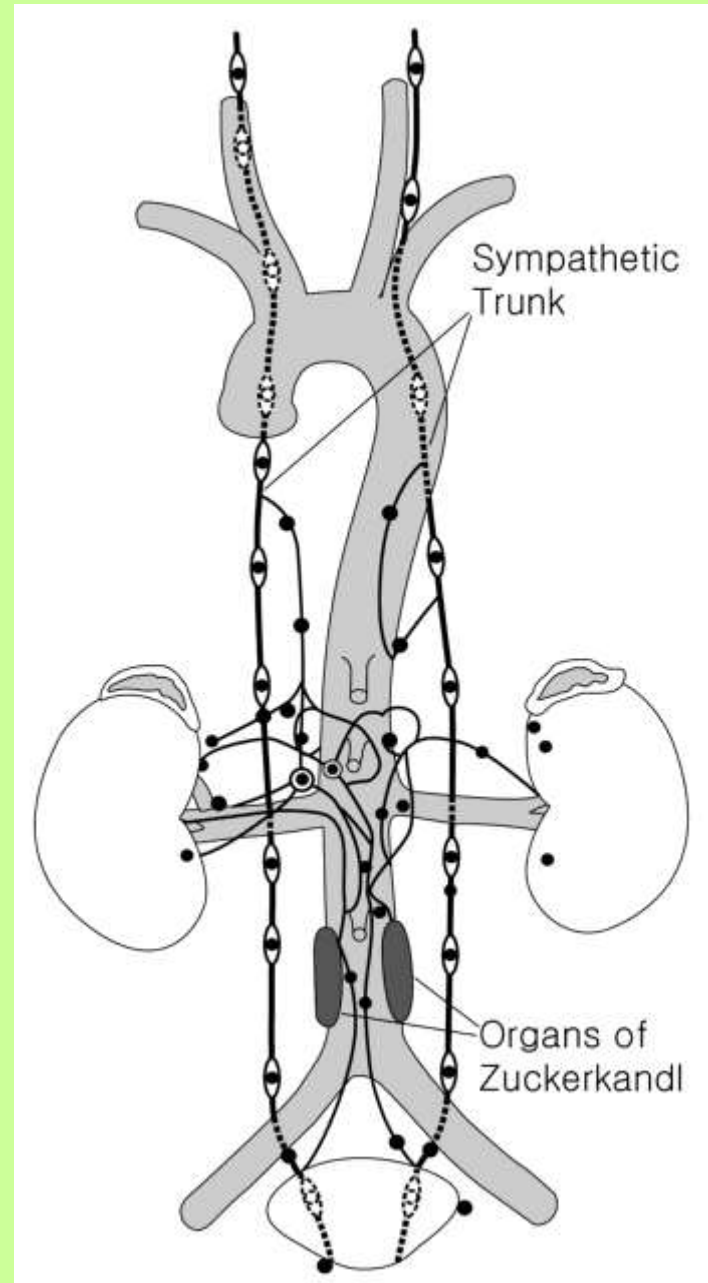
Hypercortisolism x Hypocortisolism

Paraganglia

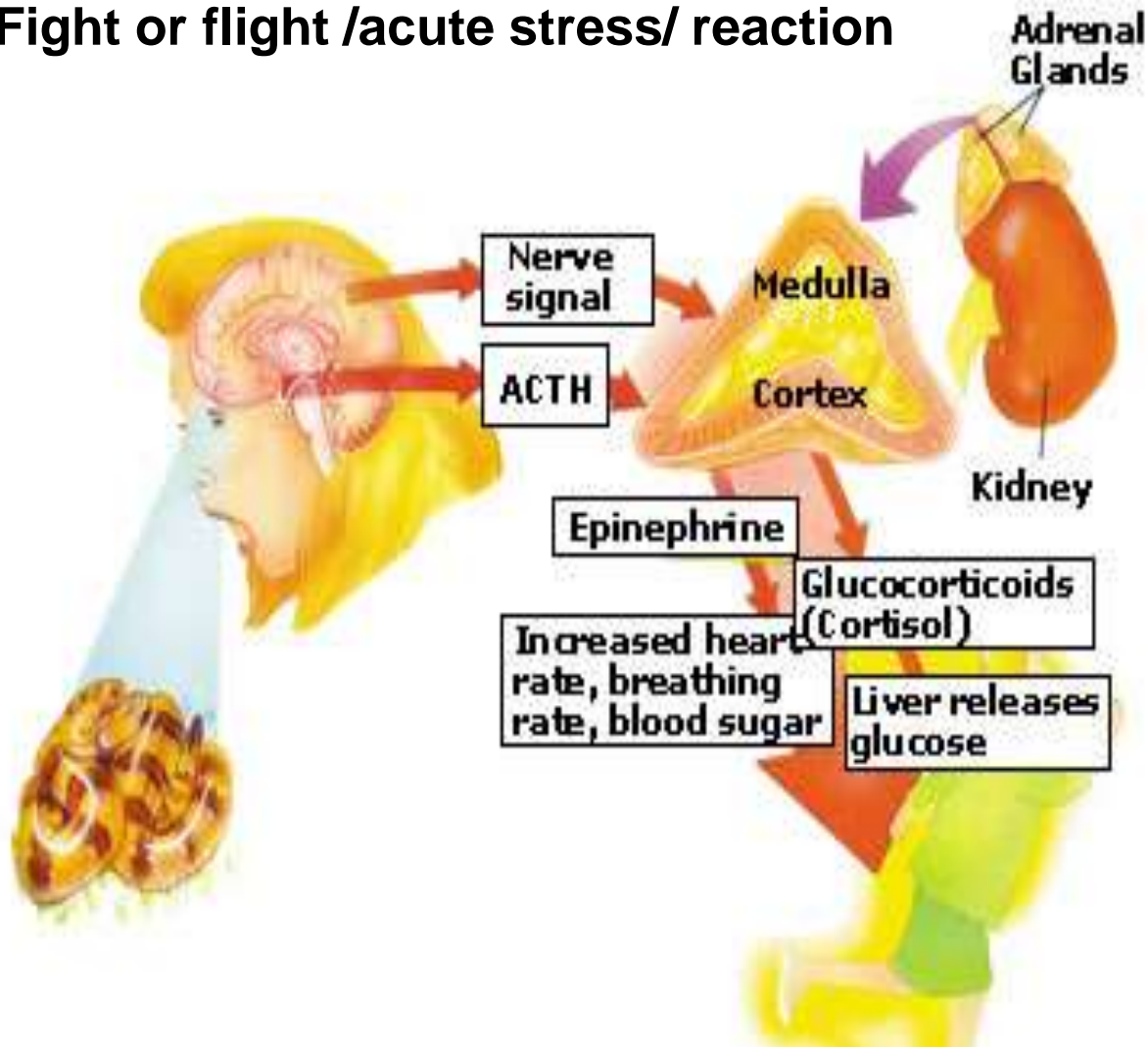
– pea sized bodies (several mm to 1-2cm) – at close relationship to vessels (aorta), autonomous nerves and symp. ggl.

- tissue similar to adrenal gland medulla – catecholamines (affecting circulation)

paraganglion aorticum abdominale
paraganglion (glomus) caroticum

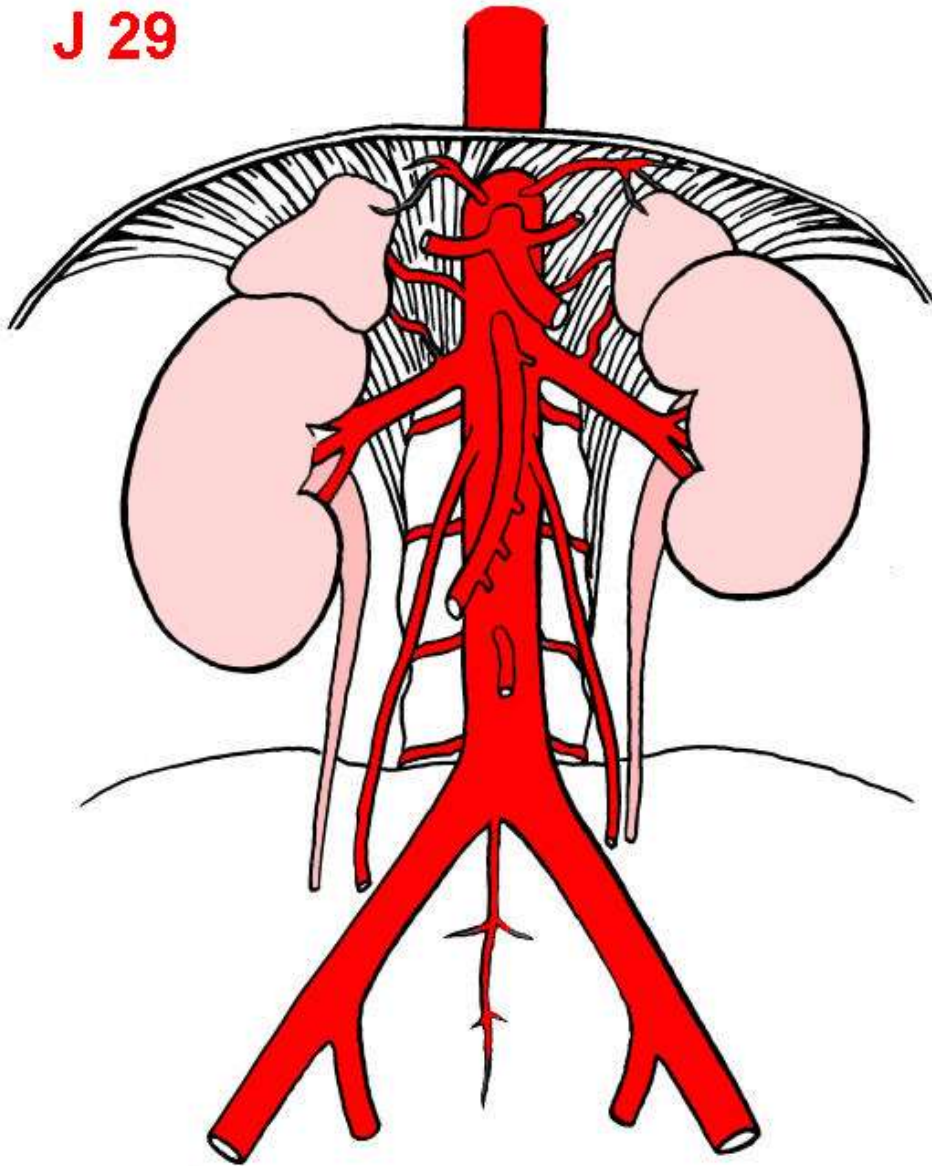


Fight or flight /acute stress/ reaction



Inappropriate activation of the stress response in modern humans (when physical action is inappropriate and/or unnecessary) can cause negative effects.

J 29



Blood supply of adrenal gland

Arteries:

- 1. superior suprarenal a. (from inf. phrenic a.)
- 2. middle suprarenal a. (from aorta abdominalis)
- 3. inferior suprarenal a. (from renal a.)

Veins:

- coming from hilus (central v.), then as suprarenal v. opens into:
 - R side – IVC
 - L side – renal v.

References

- Čihák: Anatomie 3.
- Elišková, Naňka : Přehled anatomie
- Netter: Anatomical atlas
- Grant: Anatomical Dissector
- Sadler: Human Embryology
- Junquiera: Basic Histology
- Original research papers
- Internet
- Doc. Naňka (parath. gland photos)