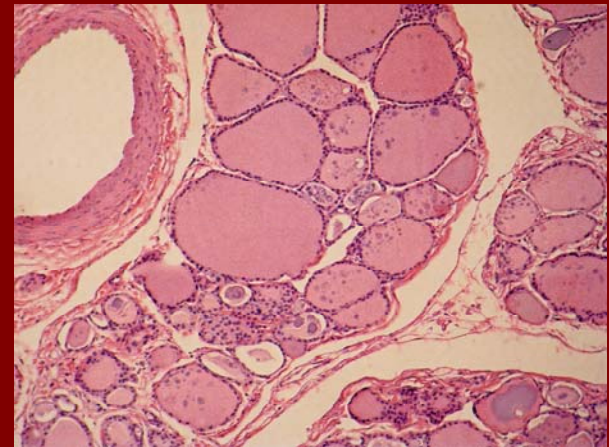
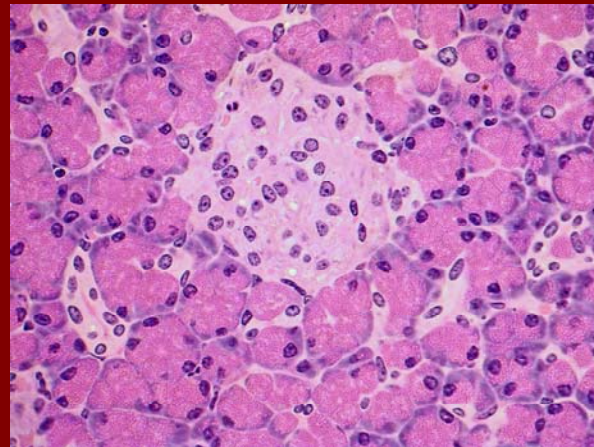


Histology of the ENDOCRINE SYSTEM

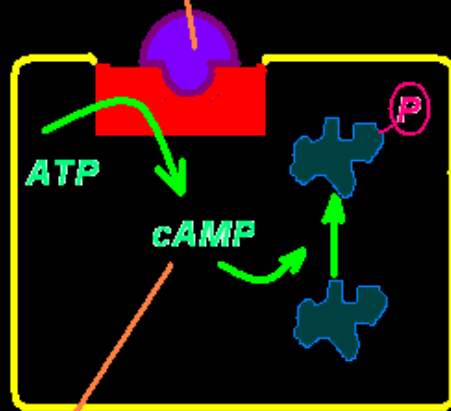
(excluding Reproductive Hormones
– see ‘EMBRYOLOGY’)

*Hormones, steroidal & proteinaceous, secreted directly into
Blood for chemical homeostatic control of tissues and
organs—NO ducts*

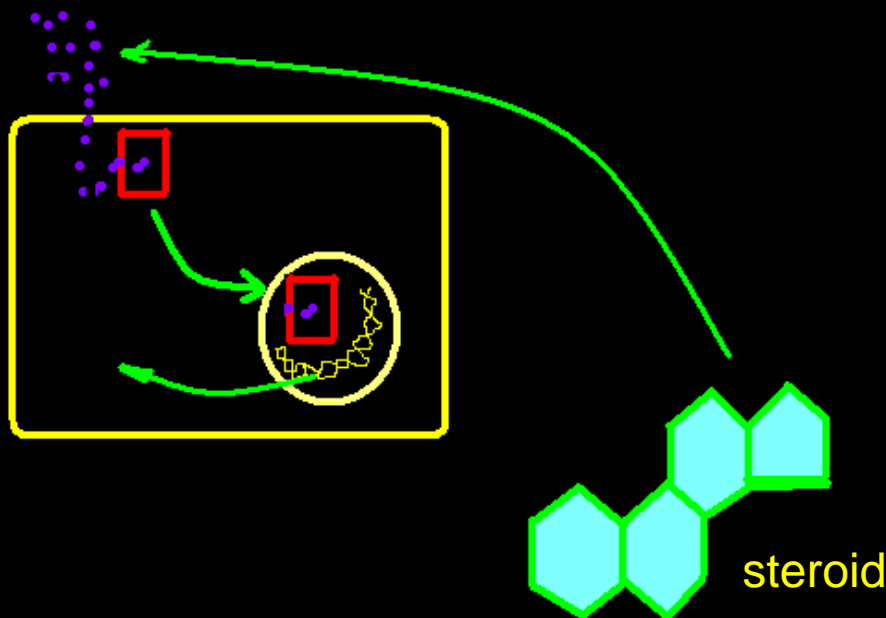


HORMONE TYPES

1st Messenger



2nd Messenger

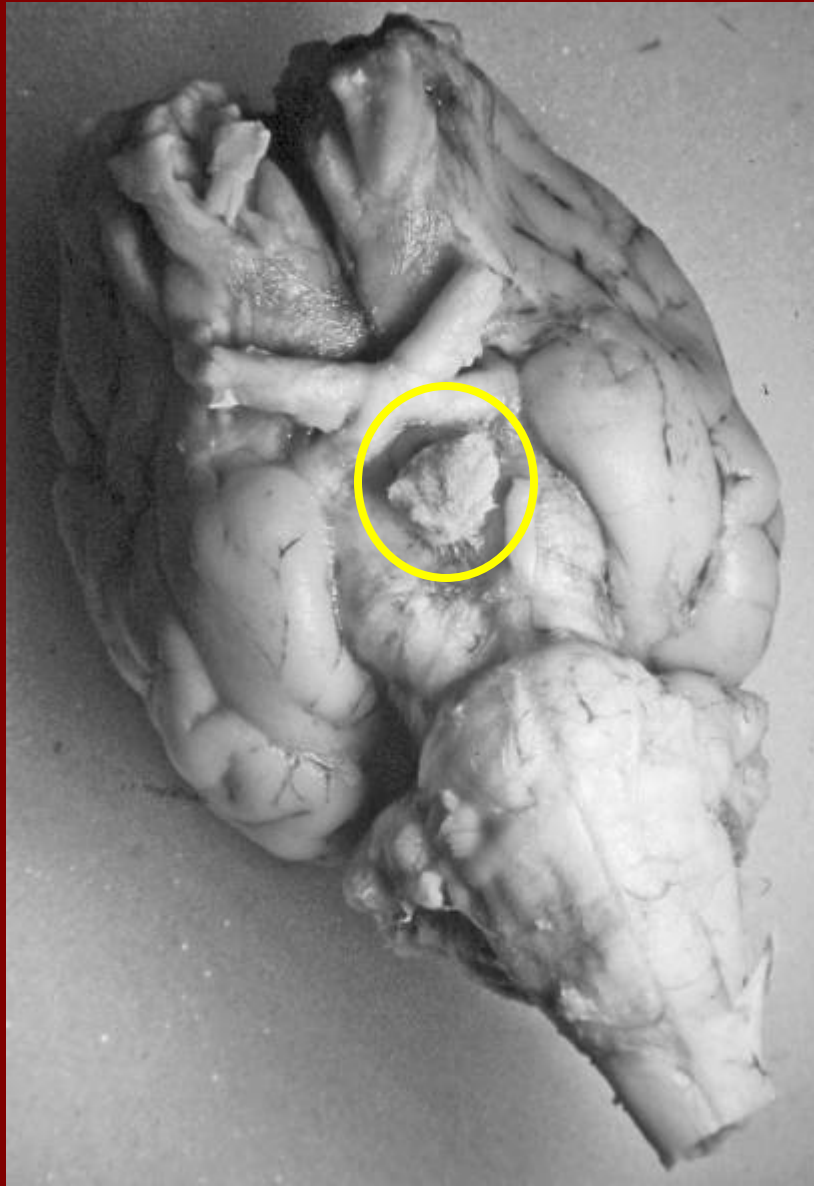


1) POLYPEPTIDES:
(Glucagon, Thyroxine, etc.) amino acid chains that *don't enter cell* but attach to surface receptor causing ATP to become cyclicAMP that will **phosphorylate** an inactive enzyme to be active thus speeding up or slowing down cell activity.

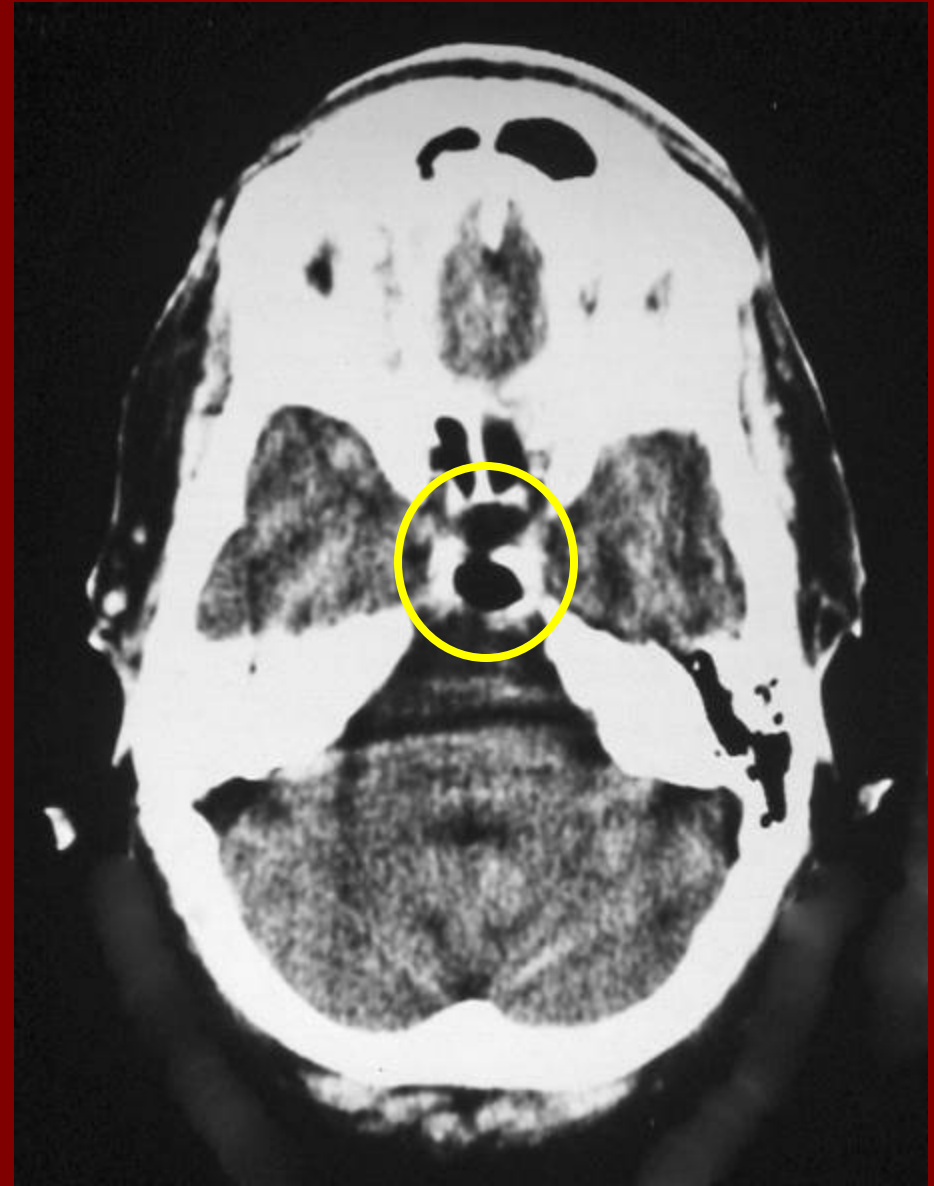
2) STEROIDS: pass through cell memb. and attach to a cytoplasmic receptor that enters nucleus & triggers **protein synthesis** of an enzyme that will alter cell functions: thus gene expression is directly effected.

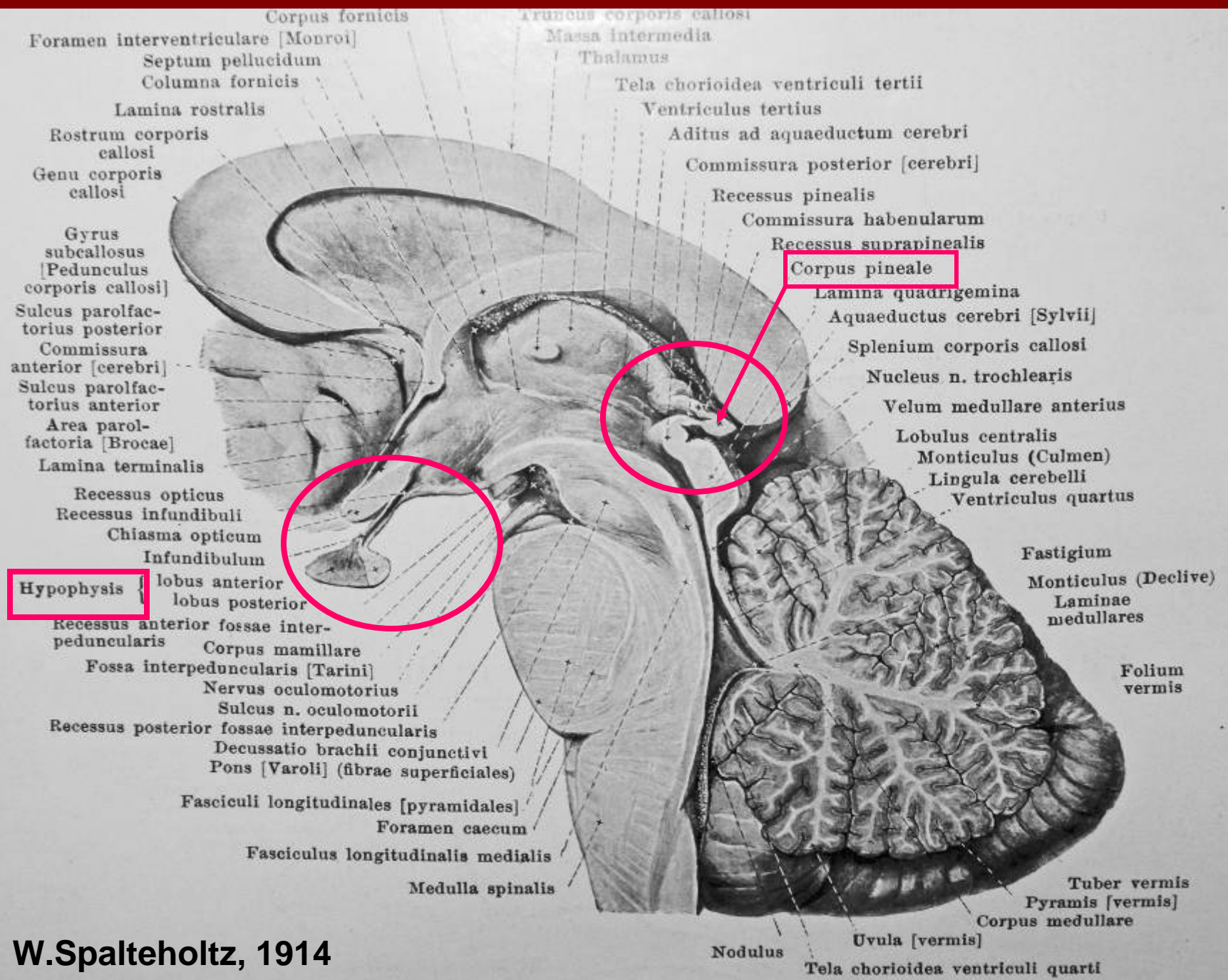
**PINEAL BODY
PITUITARY
(HYPOPHYSIS) &
Hypothalamus**

Pituitary (at base of a sheep's brain)



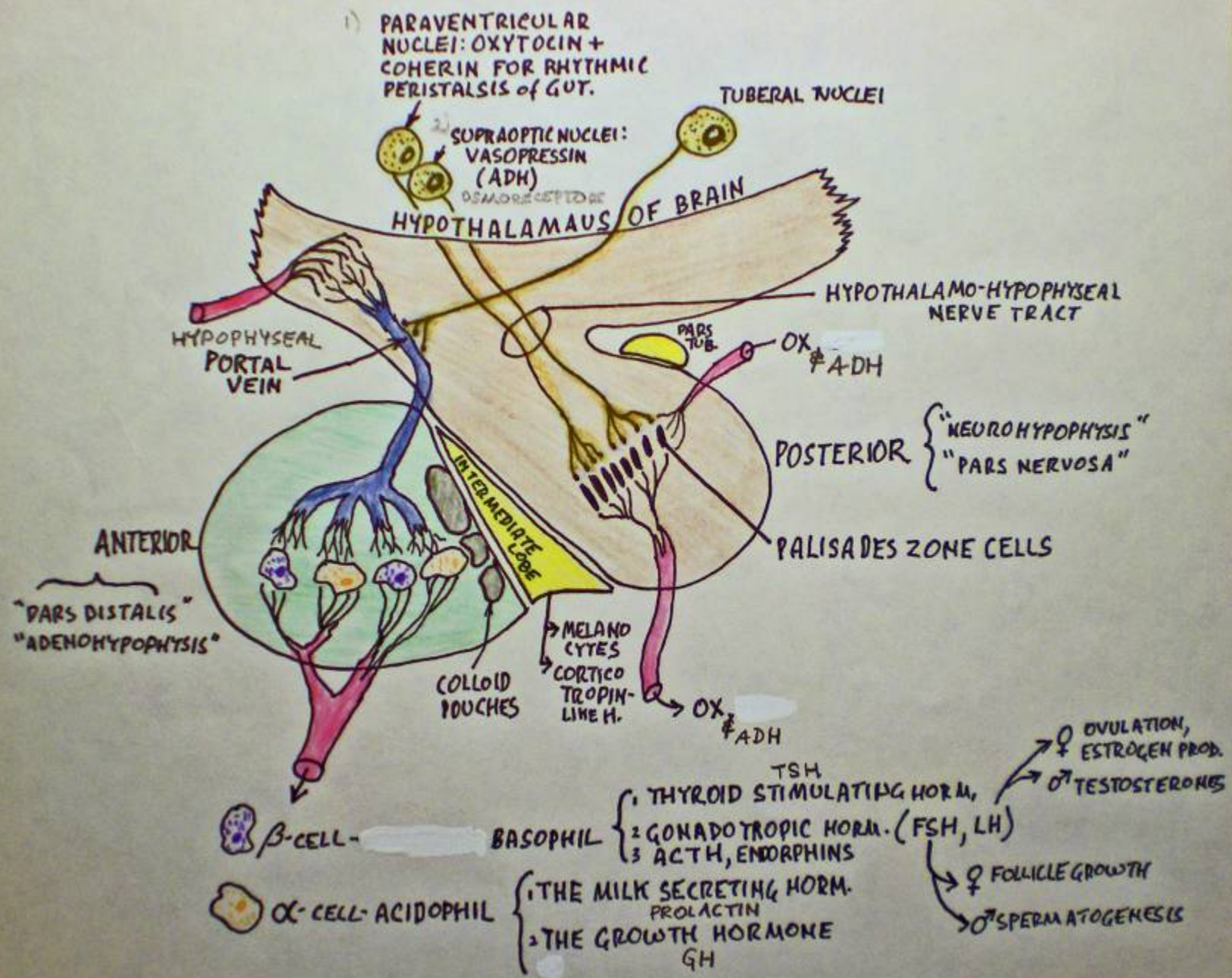
Human CT Scan

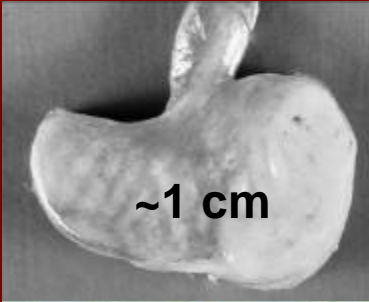




W.Spalteholtz, 1914

CYTOTROPIC RELEASING HORMONE





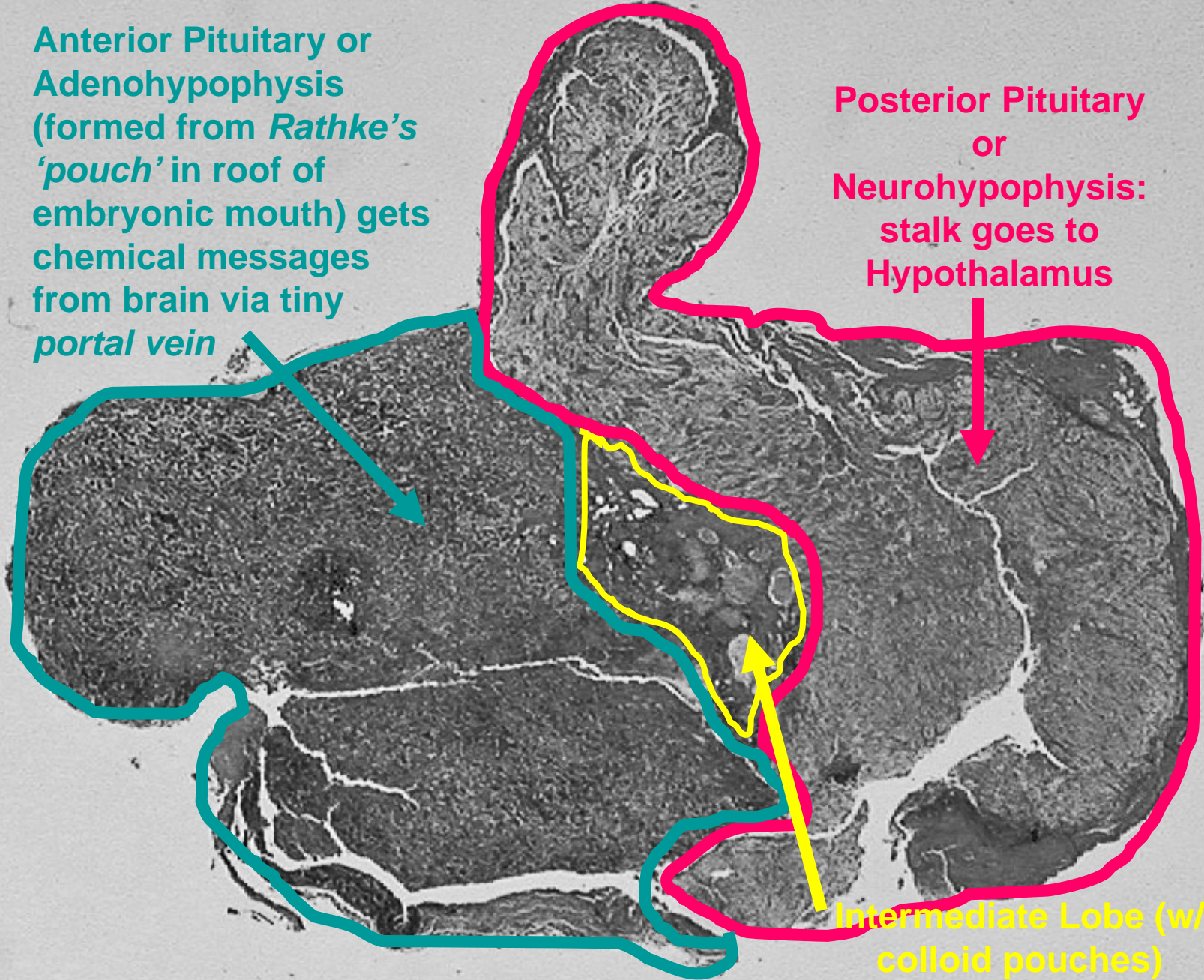
~1 cm



Anterior Pituitary or Adenohypophysis (formed from *Rathke's pouch* in roof of embryonic mouth) gets chemical messages from brain via tiny *portal vein*

Posterior Pituitary or Neurohypophysis: stalk goes to Hypothalamus

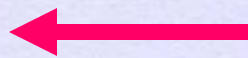
Intermediate Lobe (w/ colloid pouches)



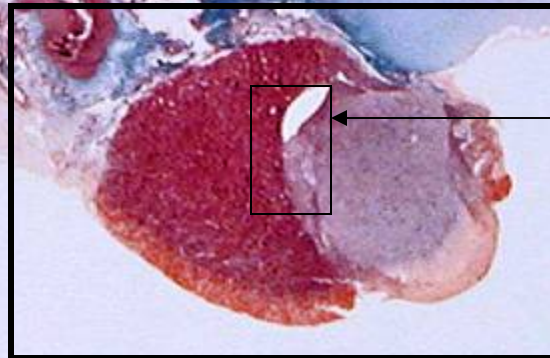
CRH – Corticotropic
Releasing Horm. To
Ant. Pituitary that
releases ACTH

Hypothalamus of Brain

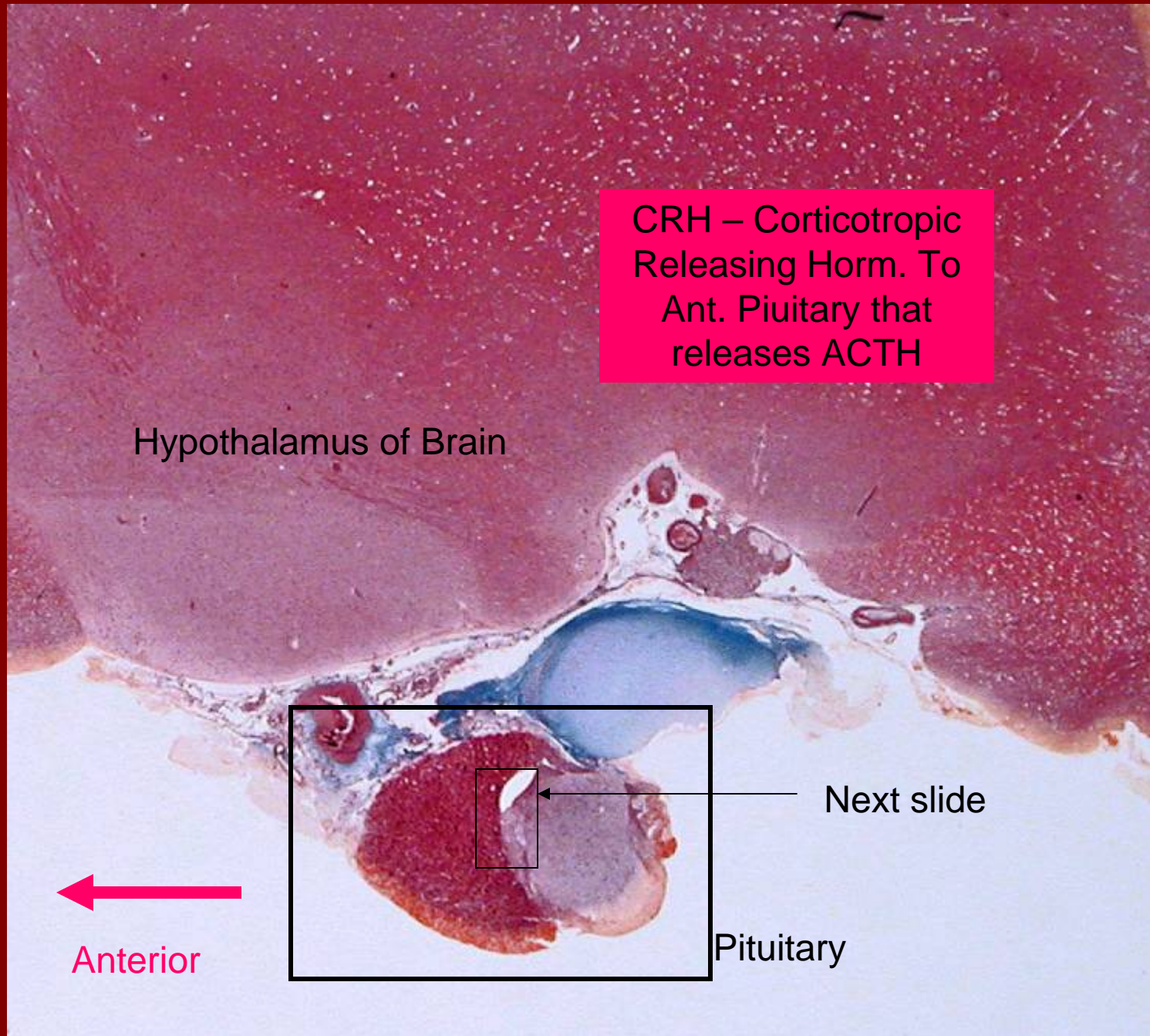
Next slide




Anterior



Pituitary

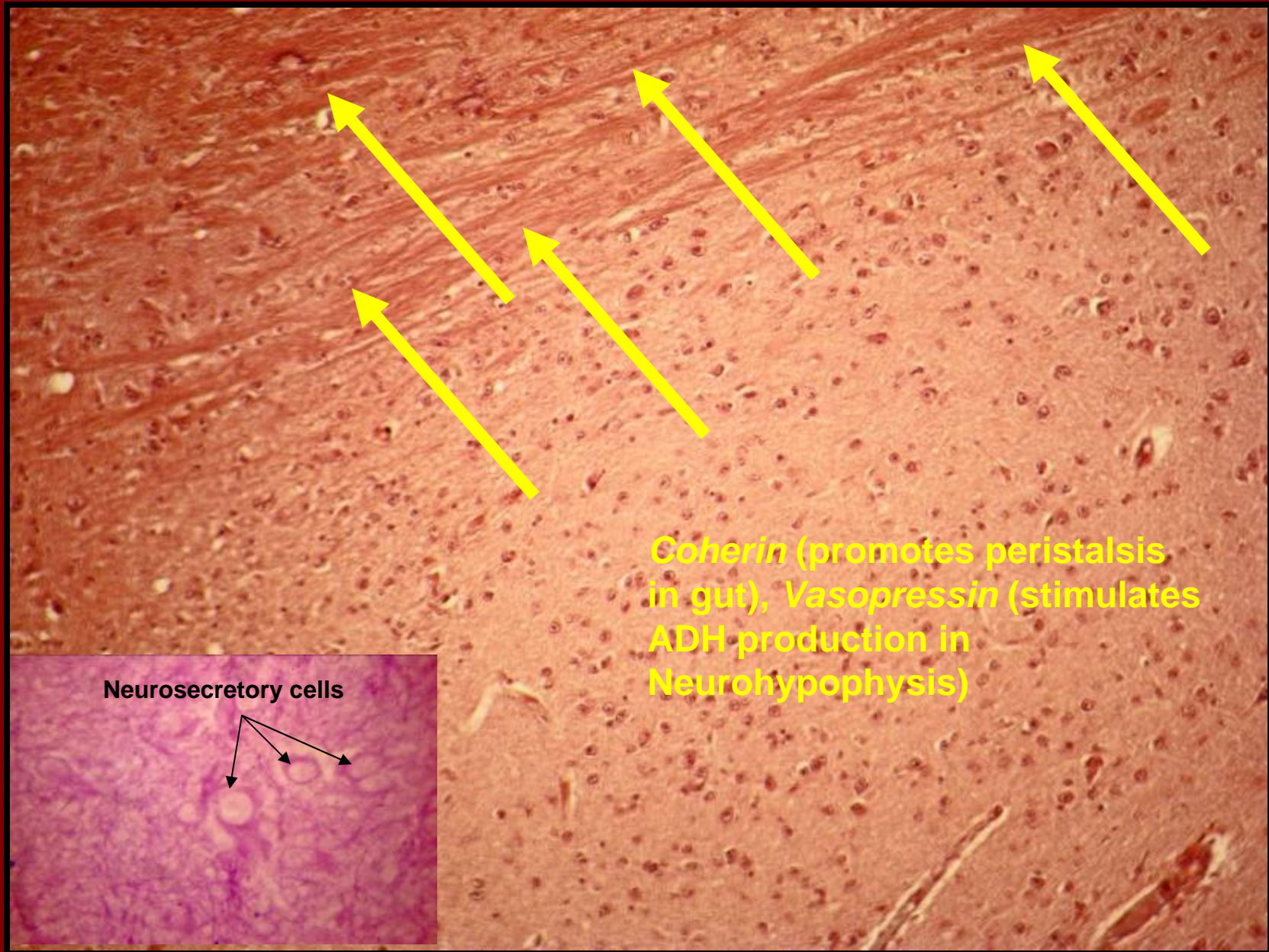




**Anterior Pituitary or
Adenohypophysis**
(formed from *Rathke's*
'pouch' in roof of
embryonic mouth) gets
chemical messages
from brain via tiny
portal vein: TSH, FSH,
LH, Prolactin (mother's
milk), GH, ACTH,
Endorphins.

**Posterior Pituitary
or
Neurohypophysis:**
(stalk goes to
Hypothalamus) ,
Oxytocin (Smooth
Muscle of pregnant
uterus to contract),
ADH (antidiuretic
hormone-reduces
urination)

**Intermediate Lobe (w/
colloid pouches)**

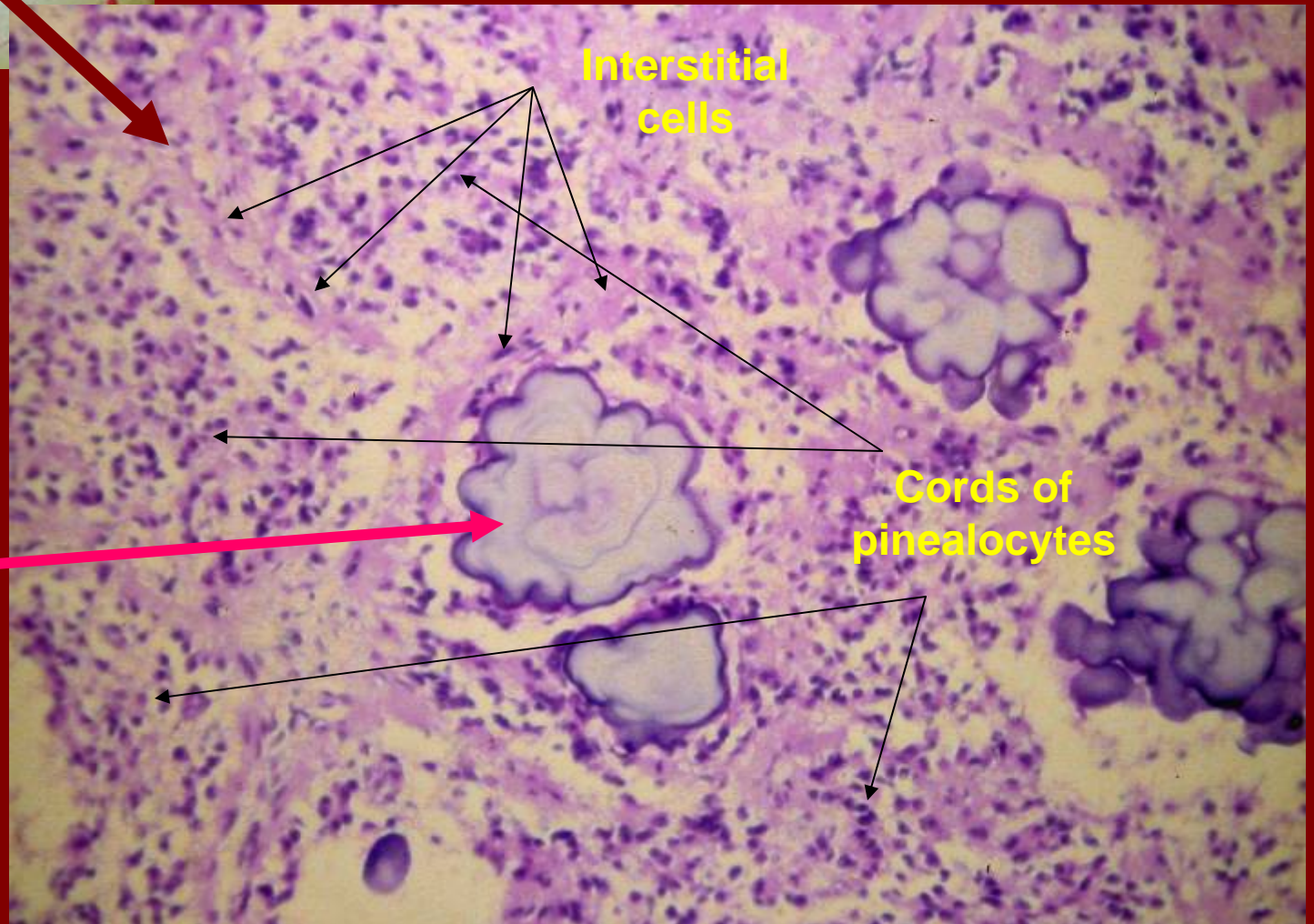
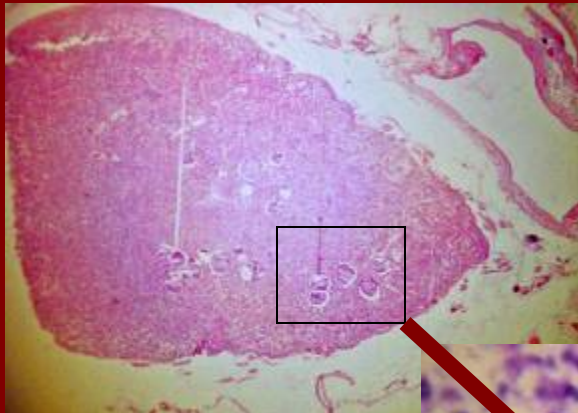


Coherin (promotes peristalsis in gut), Vasopressin (stimulates ADH production in Neurohypophysis)

Neurosecretory cells

Nerve tracts in Hypothalamus of brain going to Neurohypophysis

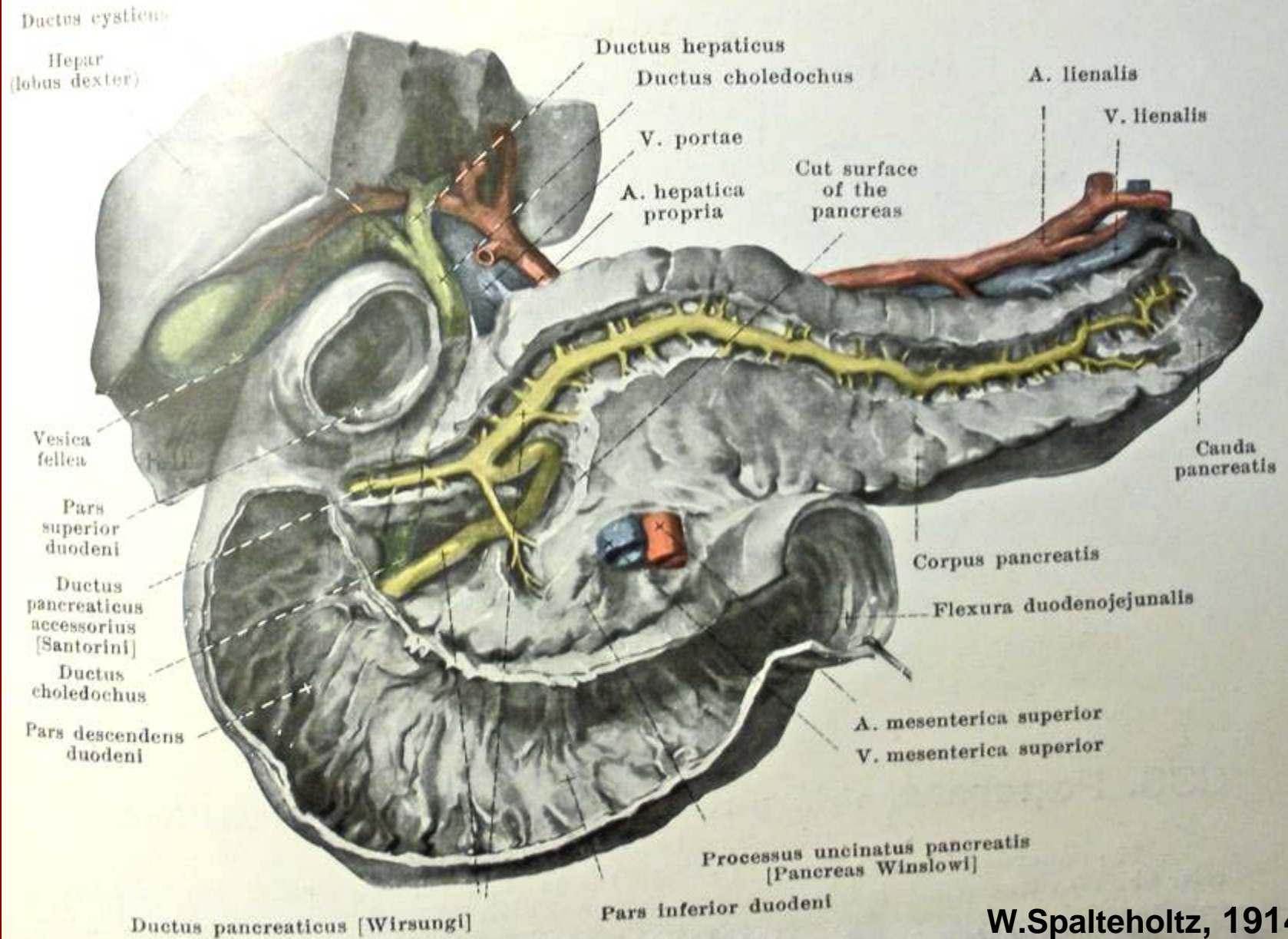
PINEAL GLAND (makes *Melatonin*)—
hormone regulates circadian cycle and
sleeping & melanin production



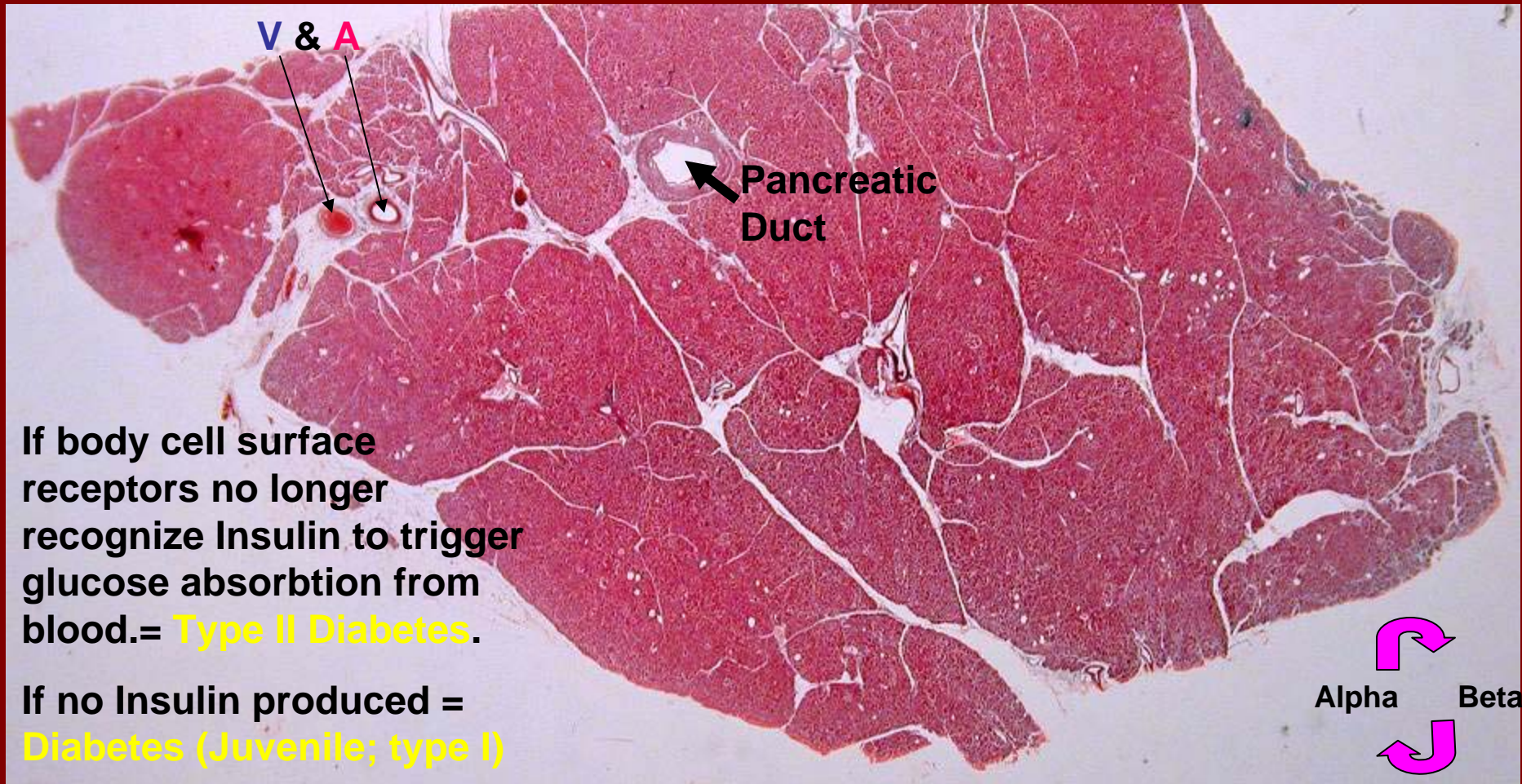
Pineal Body
has age
dependant
CT- Ca rich
granules
called *brain
sand* –
show on X-
rays

PANCREAS' ISLETS of LANGERHANS

Pancreas.



W.Spalteholtz, 1914

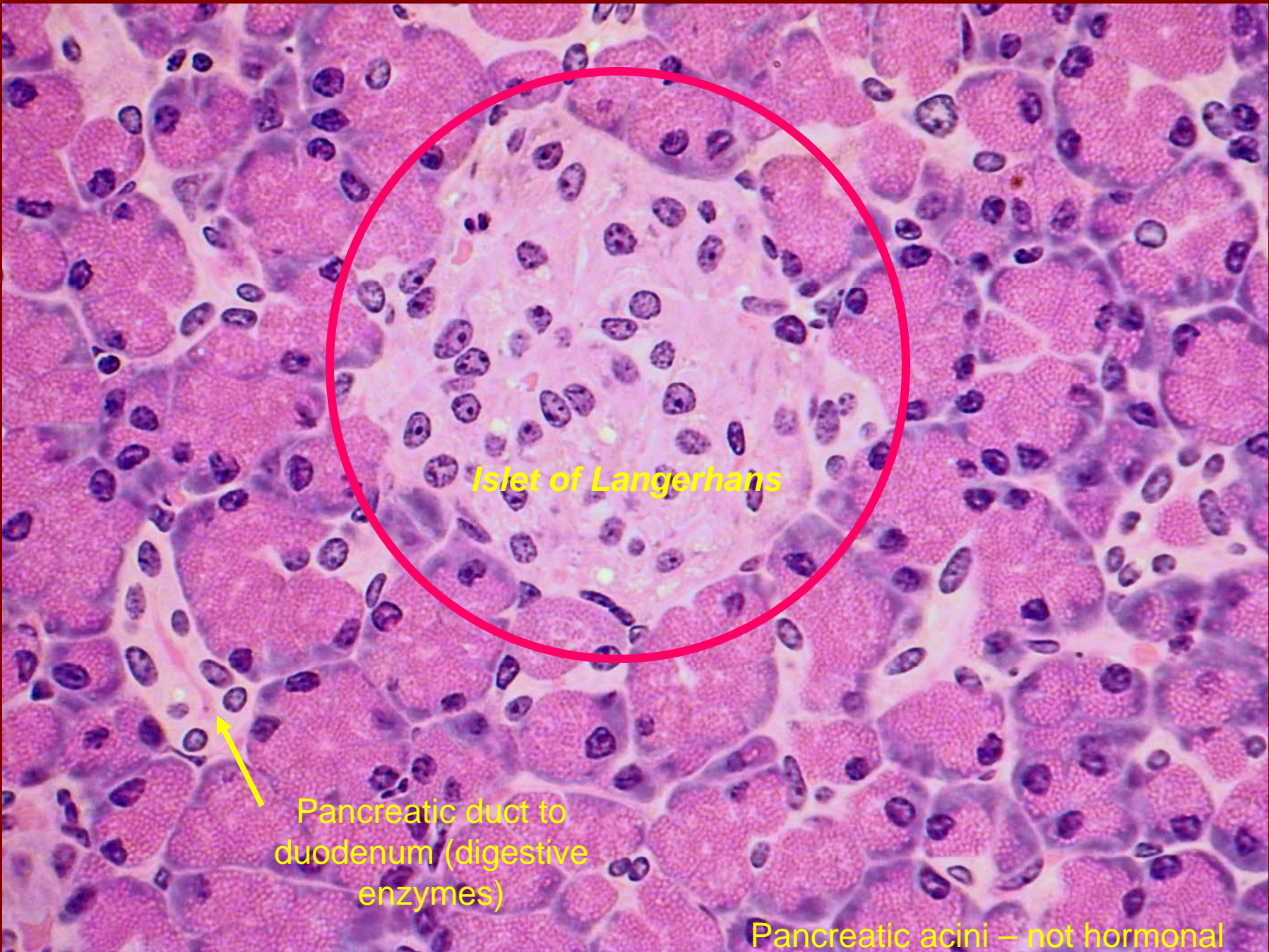


If body cell surface receptors no longer recognize Insulin to trigger glucose absorption from blood.= **Type II Diabetes.**

If no Insulin produced = **Diabetes (Juvenile; type I)**

PANCREAS: Islets of Langerhans – Insulin & Glucagon Production:

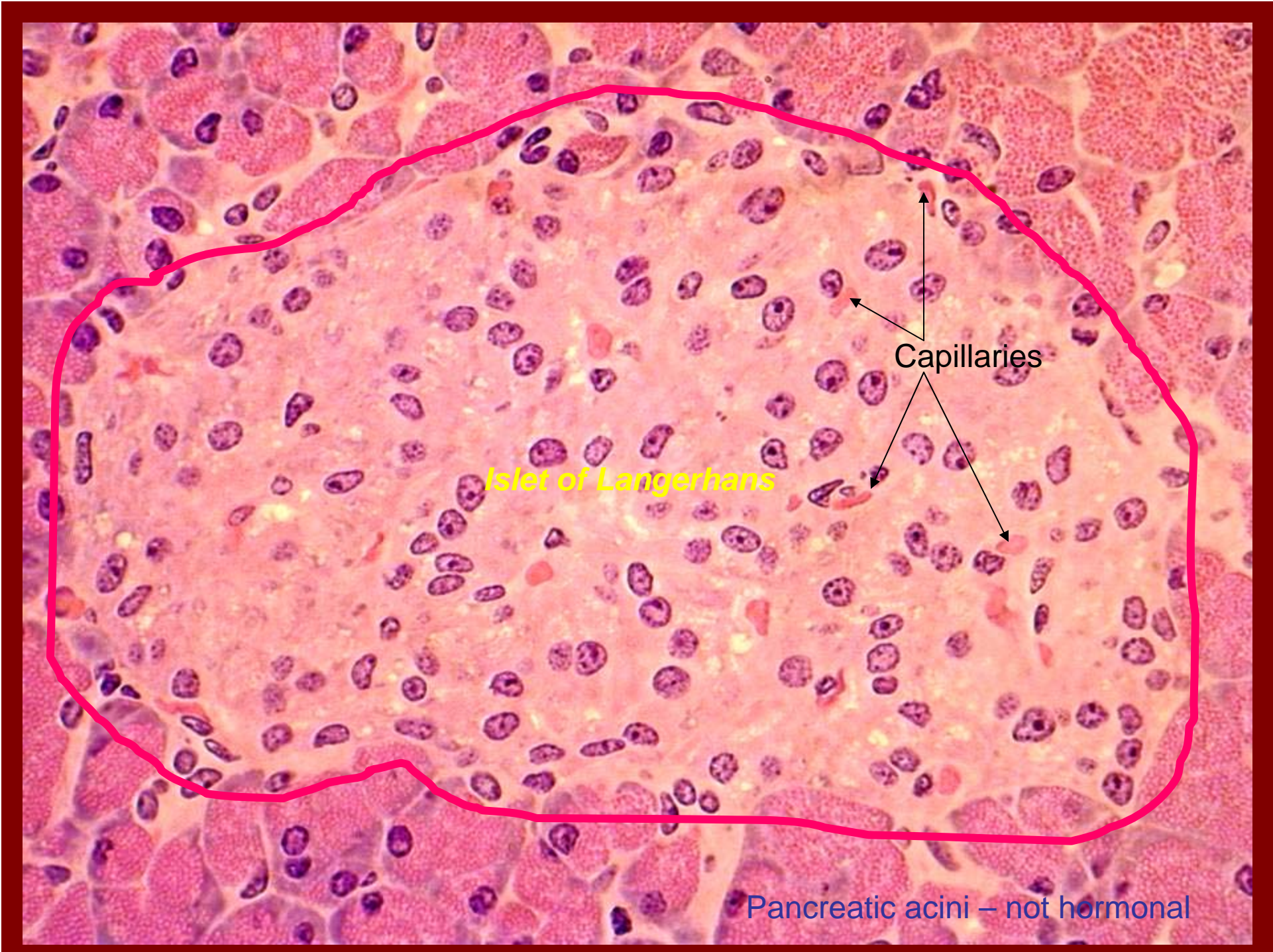
When Blood Glucose Levels High-Insulin (from Beta Cells) causes liver to convert Glucose in blood to Glycogen: When Blood Glucose is Low, Glucagon (from Alpha Cells) converts Glycogen to Glucose (in Liver) and releases it back to blood



Islet of Langerhans

Pancreatic duct to
duodenum (digestive
enzymes)

Pancreatic acini – not hormonal

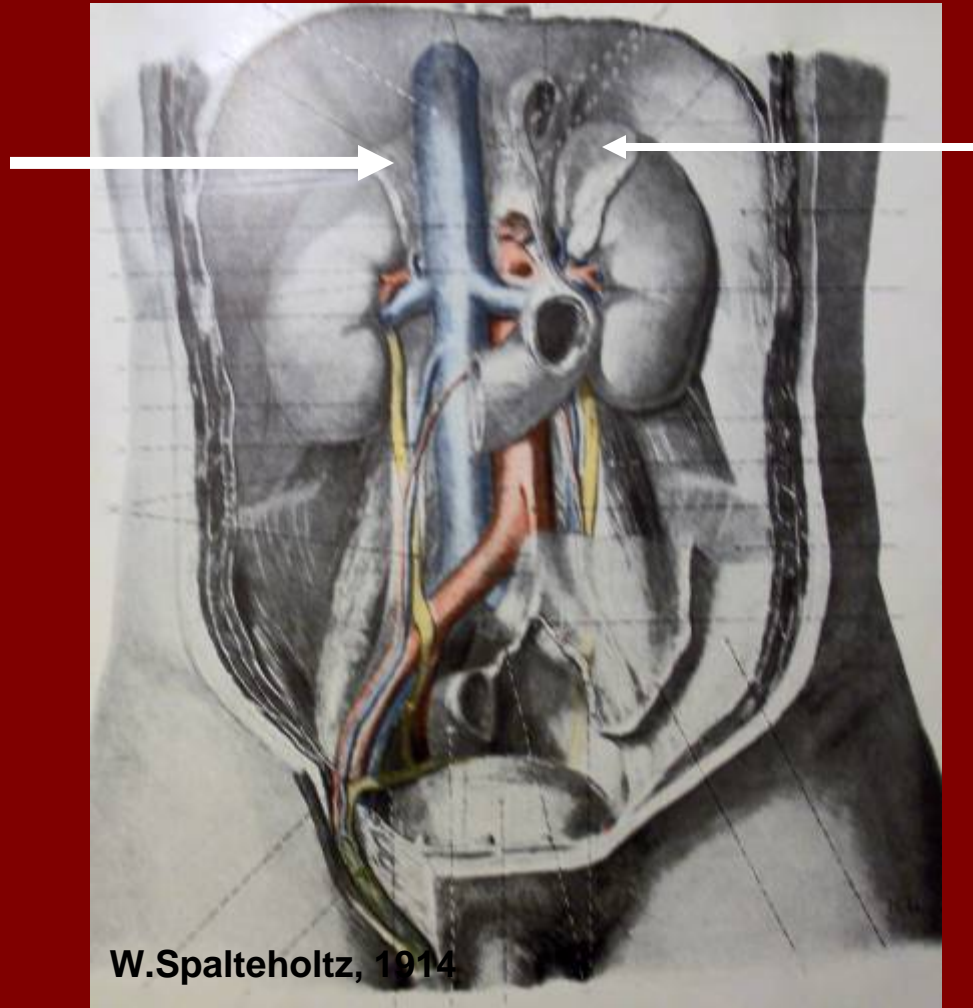


Islet of Langerhans

Capillaries

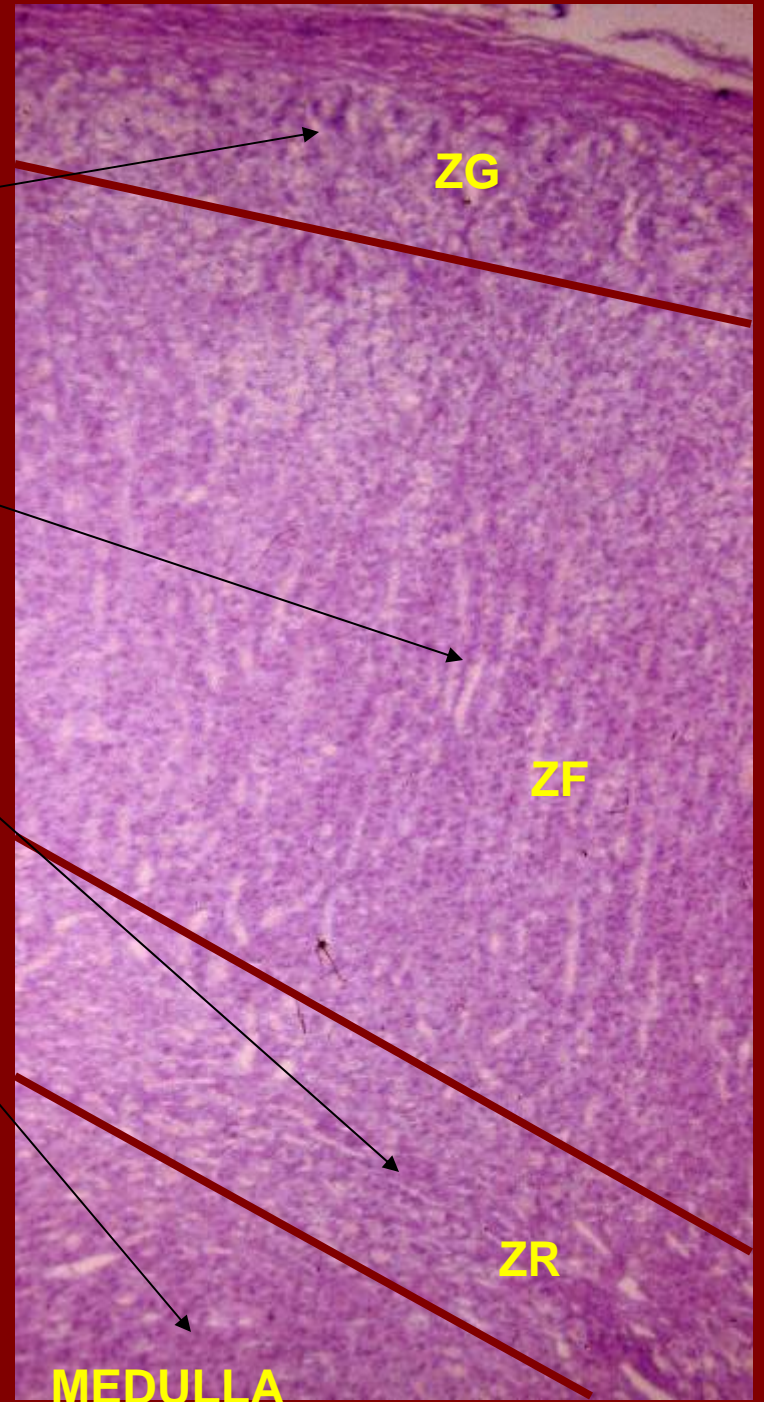
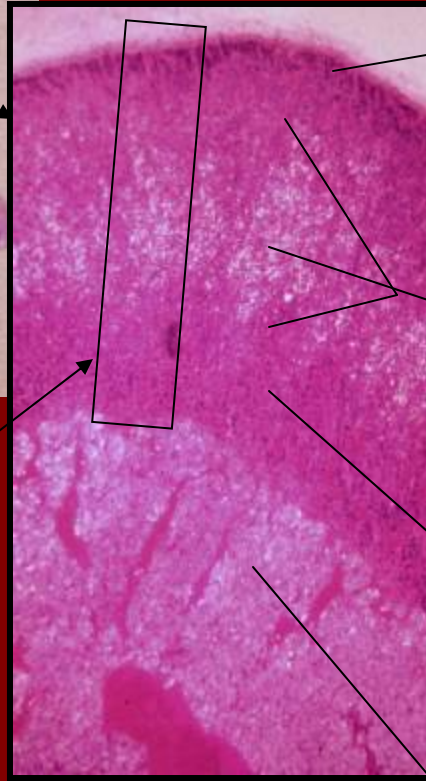
Pancreatic acini – not hormonal

ADRENAL GLAND





CORTEX



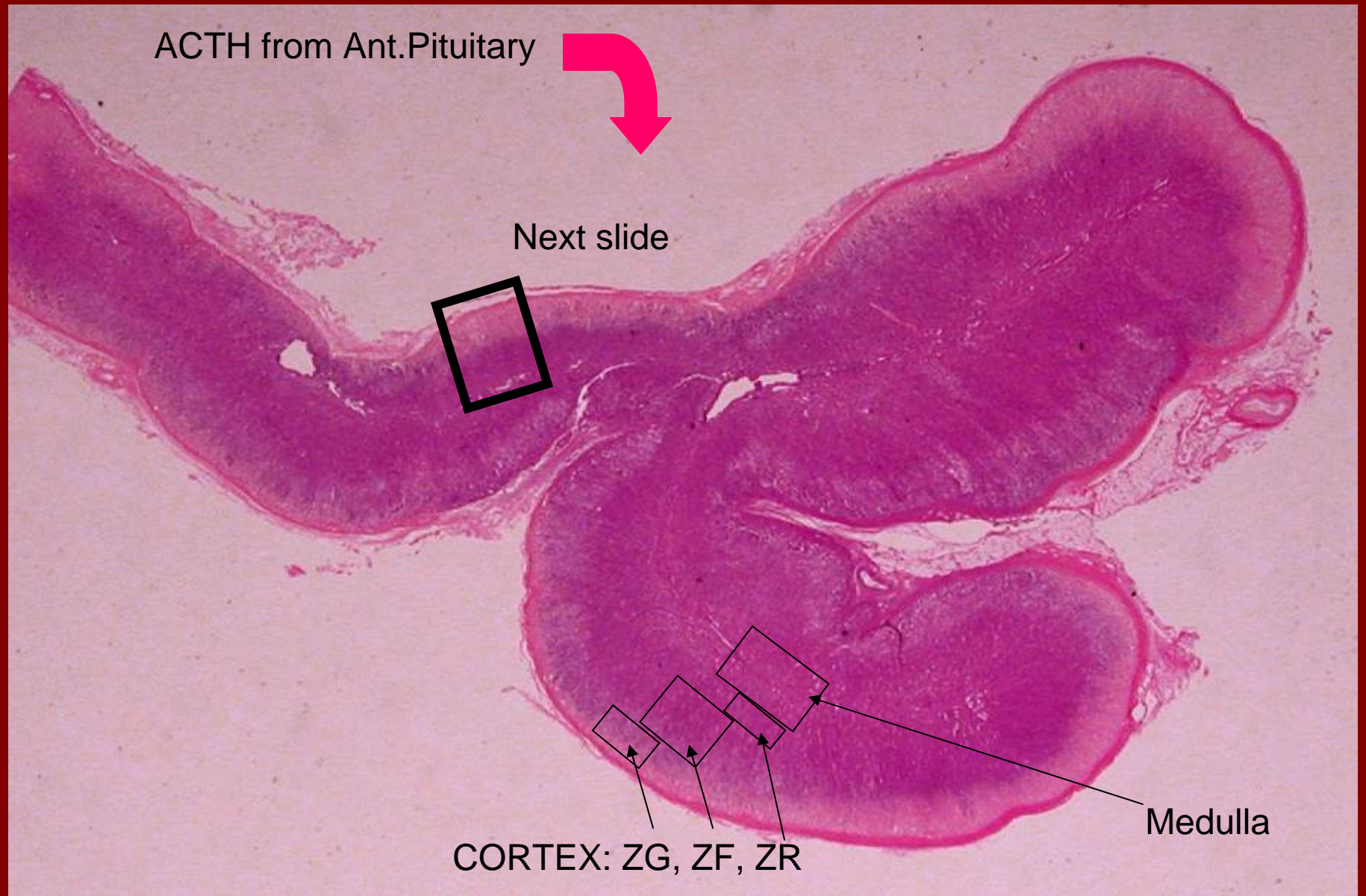
ZG

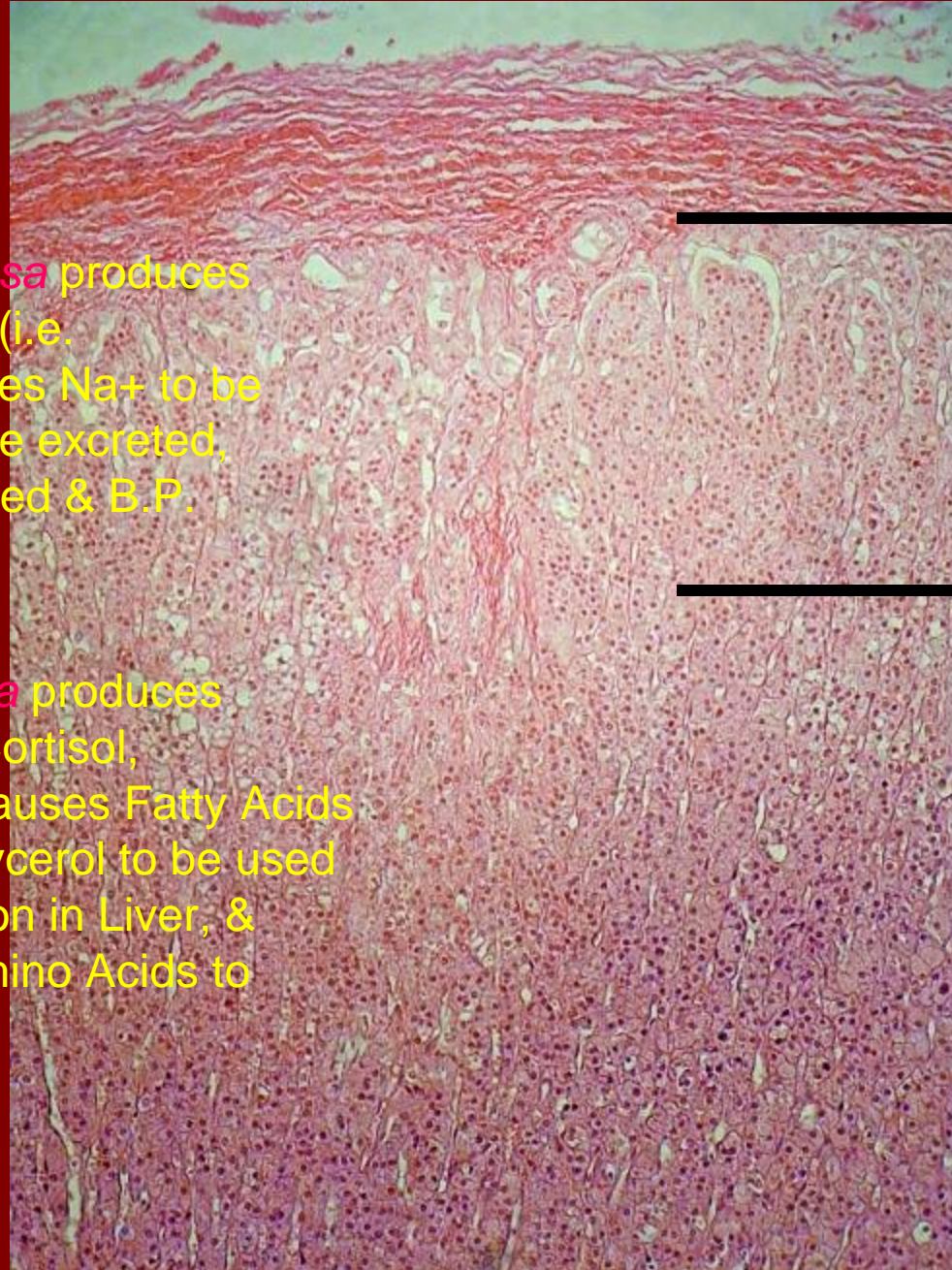
ZF

ZR

MEDULLA

Adrenal or Suprarenal Gland – rests above each kidney





Fibrous Capsule

Zona Glomerulosa

Zona Fasciculata

1) *Zona Glomerulosa* produces *Mineralocorticoids* (i.e. Aldosterone): causes Na^+ to be conserved, K^+ to be excreted, thus water is retained & B.P. rises.

2) *Zona Fasciculata* produces *Glucocorticoids* (Cortisol, Hydrocortisone): causes Fatty Acids to burn quickly, Glycerol to be used in Glucose formation in Liver, & Liver to convert Amino Acids to Glucose.

Adrenal Cortex: Mesodermal origin(steroid manufacturer)-

1) *Zona Glomerulosa* produces *Mineralocorticoids* (i.e. Aldosterone): causes Na⁺ to be conserved, K⁺ to be excreted, thus water is retained & B.P. rises.

2) *Zona Fasciculata* produces *Glucocorticoids* (Cortisol, Hydrocortisone): causes Fatty Acids to burn quickly, Glycerol to be used in Glucose formation in Liver, & Liver to convert Amino Acids to Glucose.

3) *Zona Reticulata* produces *Androgens* for secondary sexual characteristics

Adrenal Cortex Diseases: Addison's Disease – Low B.P., Dehydration; & Cushing's Syndrome – female masculinization, tissue protein levels drop with consequent swelling, High B.P..

Adrenal Medulla: Ectodermal embryonic cells from sympathetic ganglion migrate here – produces non-steroidal amines as hormones – that act as Neurotransmitters (tyrosine to dopa to dopamine to 90% Norepinephrine & 10% Epinephrine (Adrenalin)) – the fight or flight hormones.

Zona Glomerulosa

Zona Glomerulosa

capsule

Zona Fasciculata

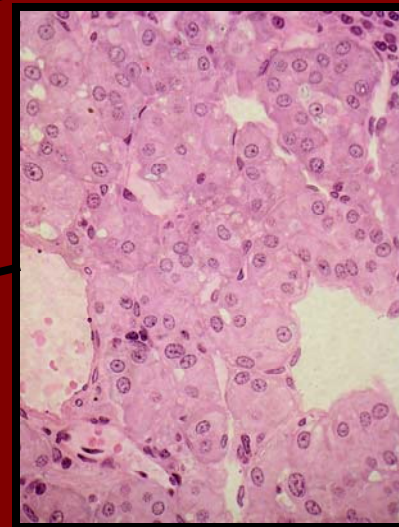
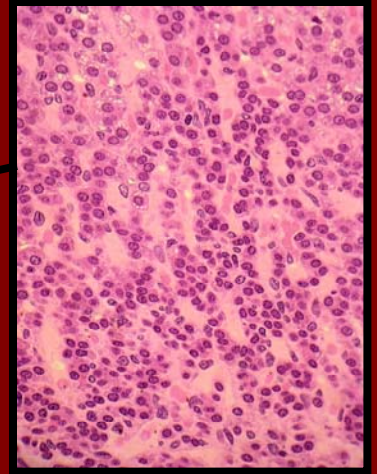
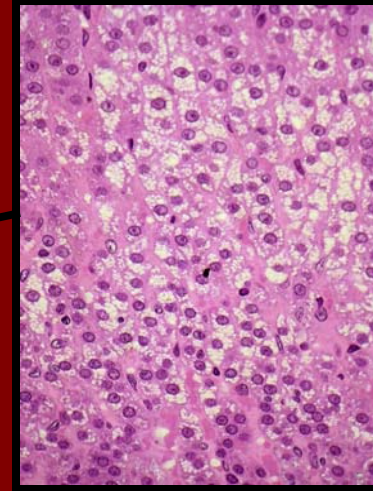
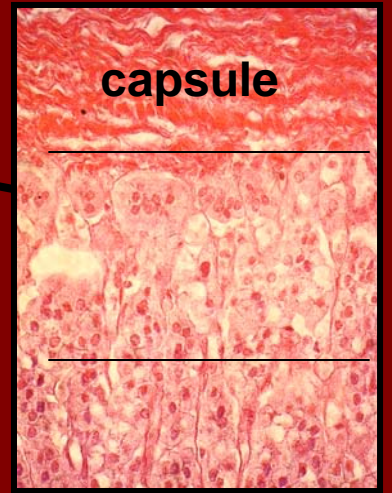
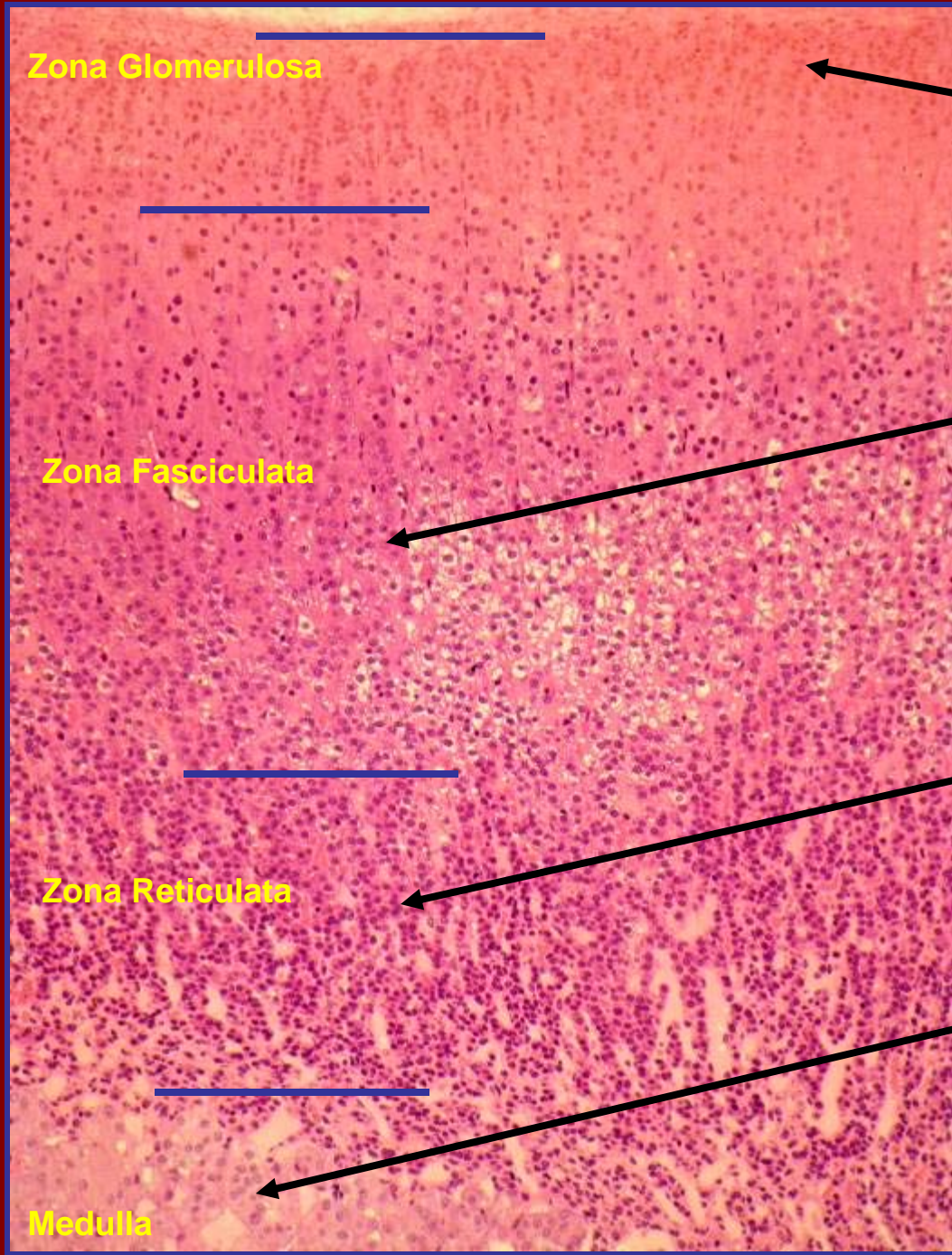
Zona Fasciculata

Zona Reticulata

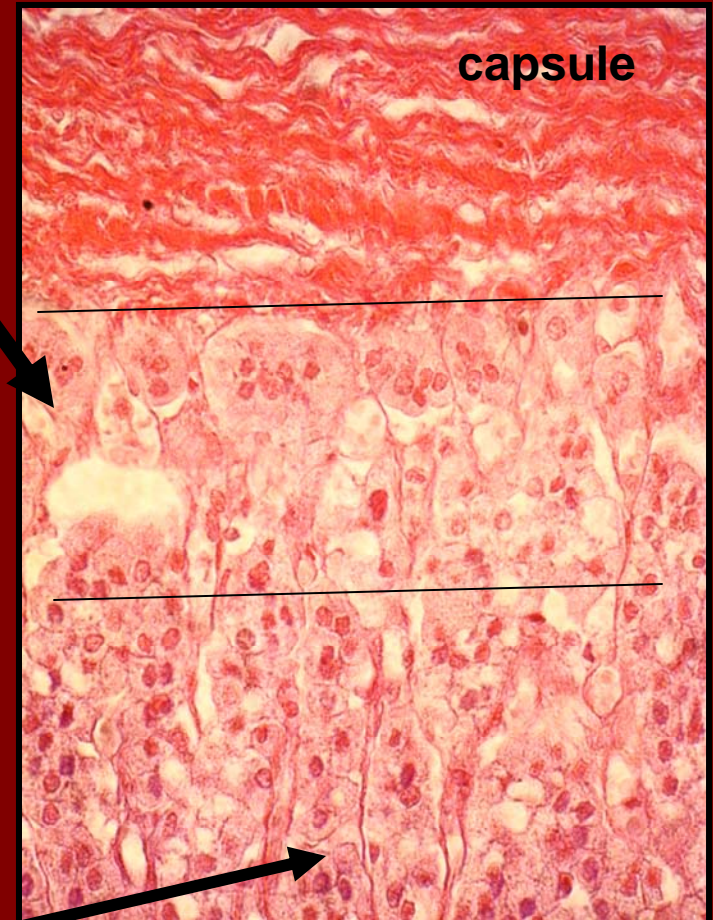
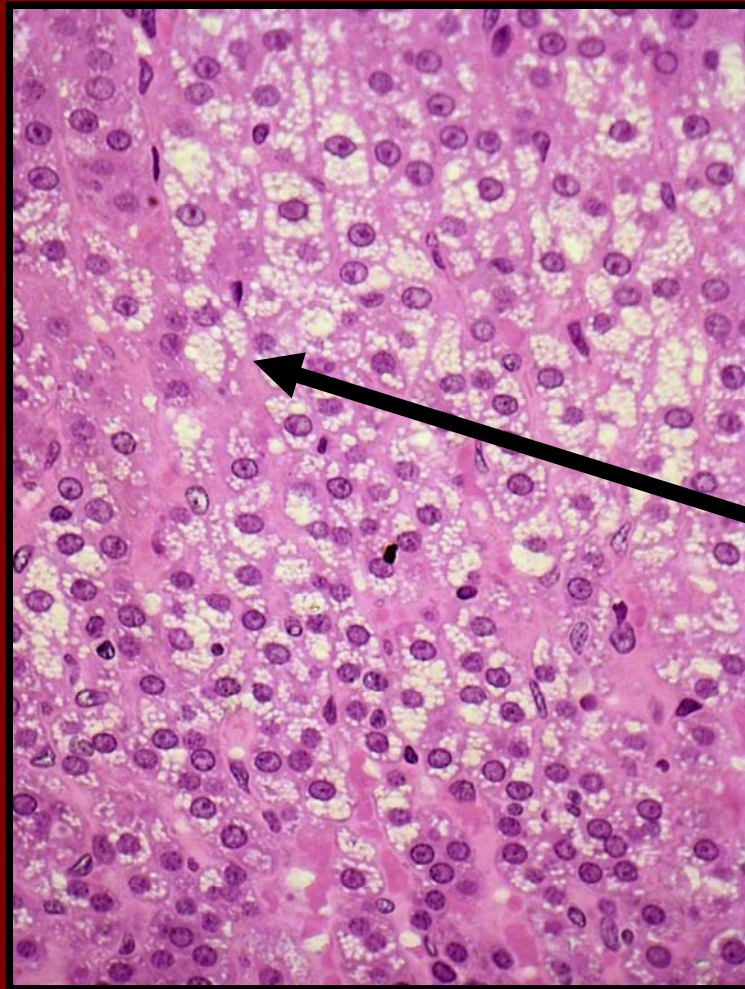
Zona Reticulata

Medulla

Medulla

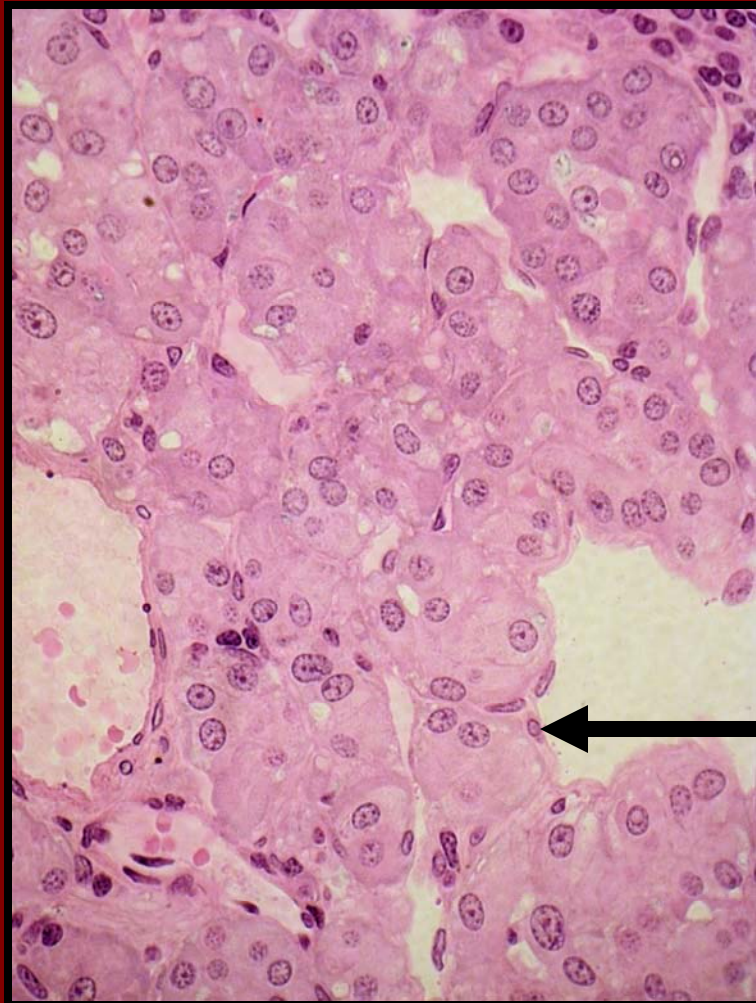


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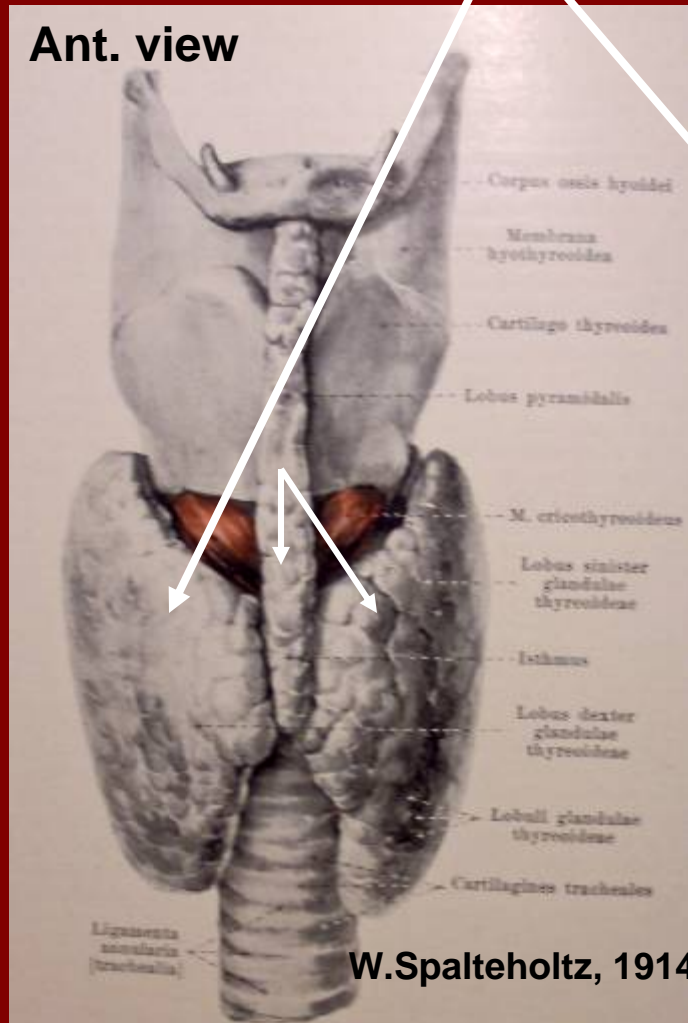
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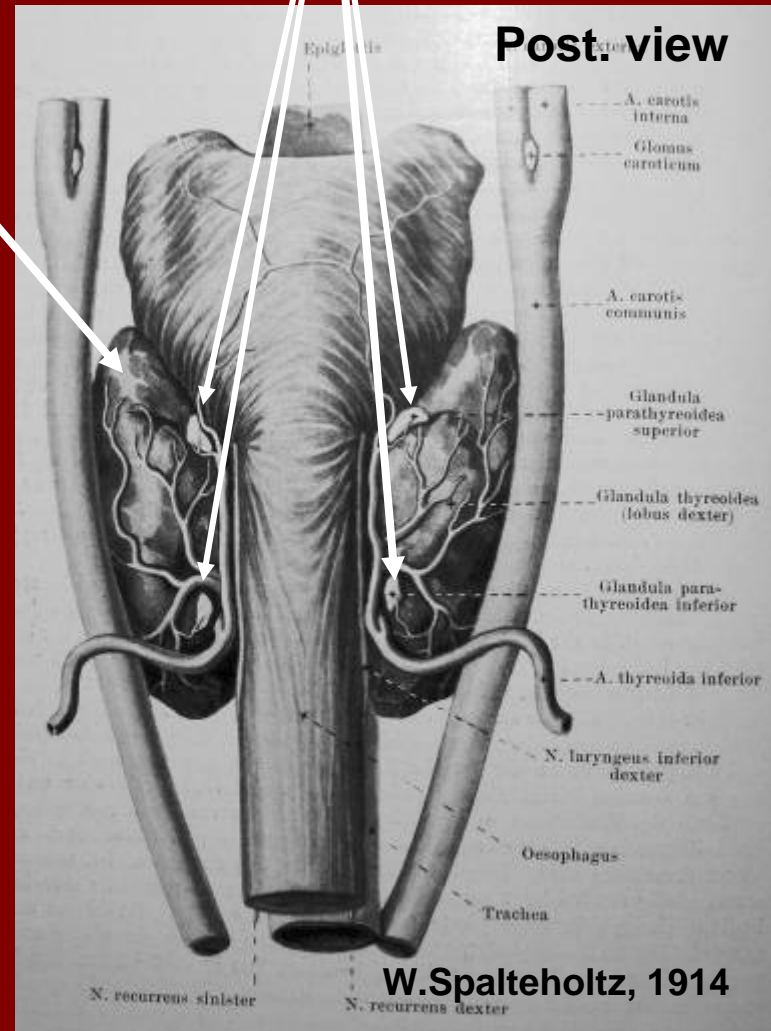
PARATHYROID & THYROID

Ant. view



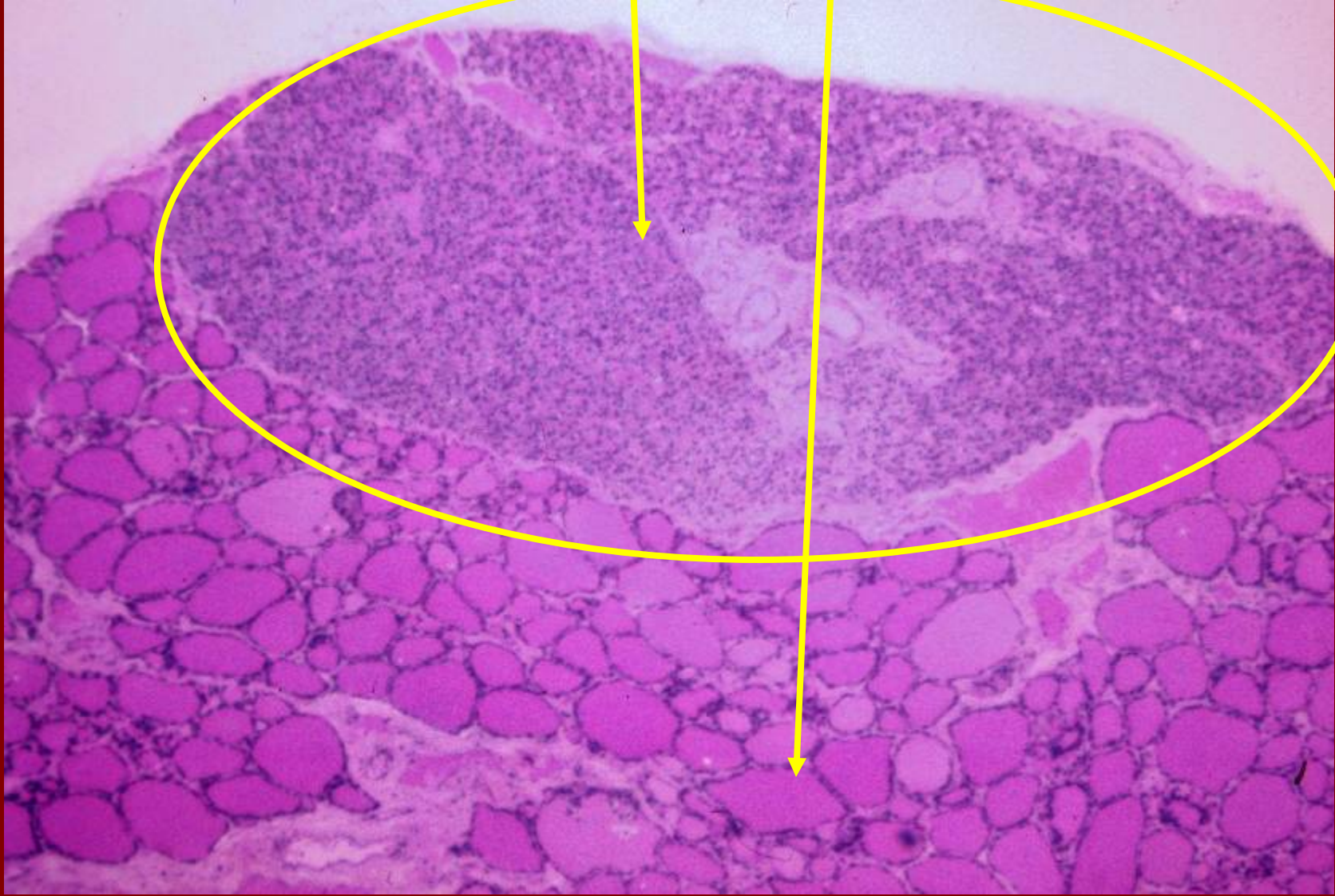
W. Spalteholtz, 1914

Post. view



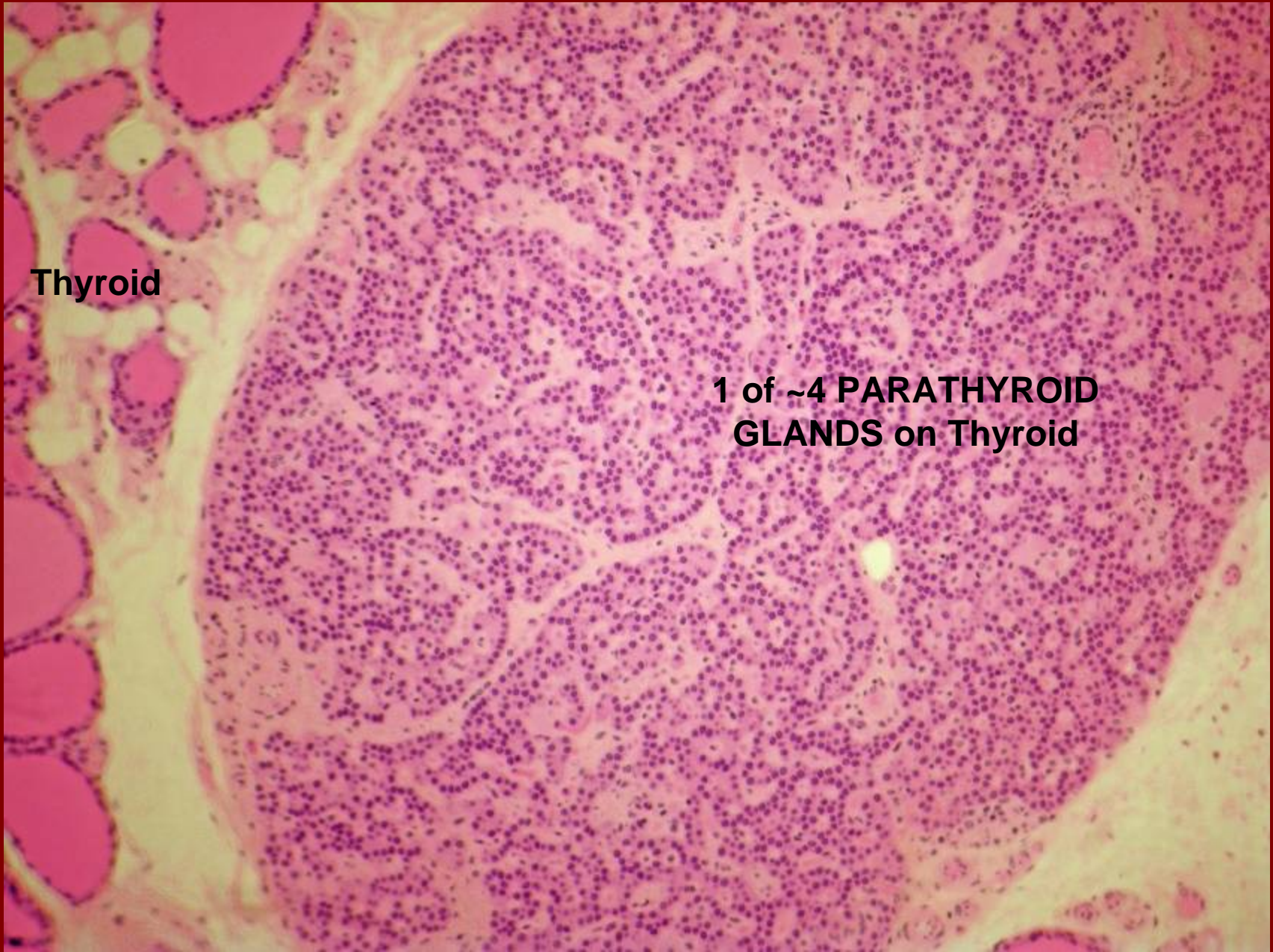
W. Spalteholtz, 1914

Parathyroid on Thyroid



Thyroid

**1 of ~4 PARATHYROID
GLANDS on Thyroid**



PARATHYROID



Parathyroid Gland: if Ca^{++} is Low, then **PTH** – Parathyroid Hormone – cause ***Osteoclasts*** in Bone to digest & release Ca^{++} (and PO_4 to be excreted in Urin: more Ca^{++} is needed for muscle activity including Heart Muscle. May be why Early Vertebrates in Freshwater (low Ca^{++}) needed to evolve bone as a storage tissue rather than just support!

Hyperparathyroidism – PTH is High, Osteoclasts destroy bone, High Blood Ca^{++} is lowered by Kidneys & Kidney stones form

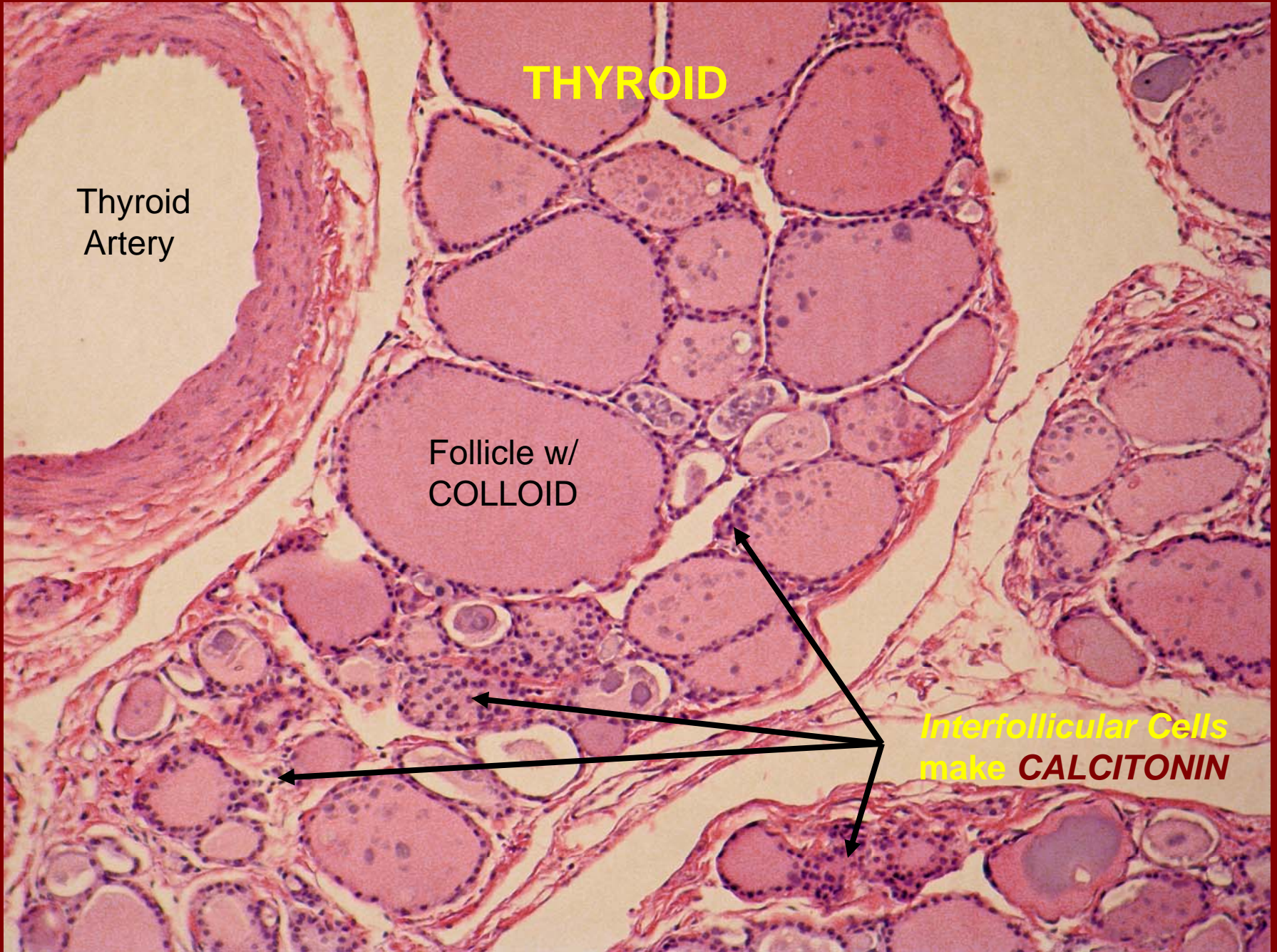
Hypoparathyroidism – Low PTH – Low osteoclast activity and CNS is Excitable which leads to muscle tetanus & Respiratory Disease. Blood Ca^{++} is High

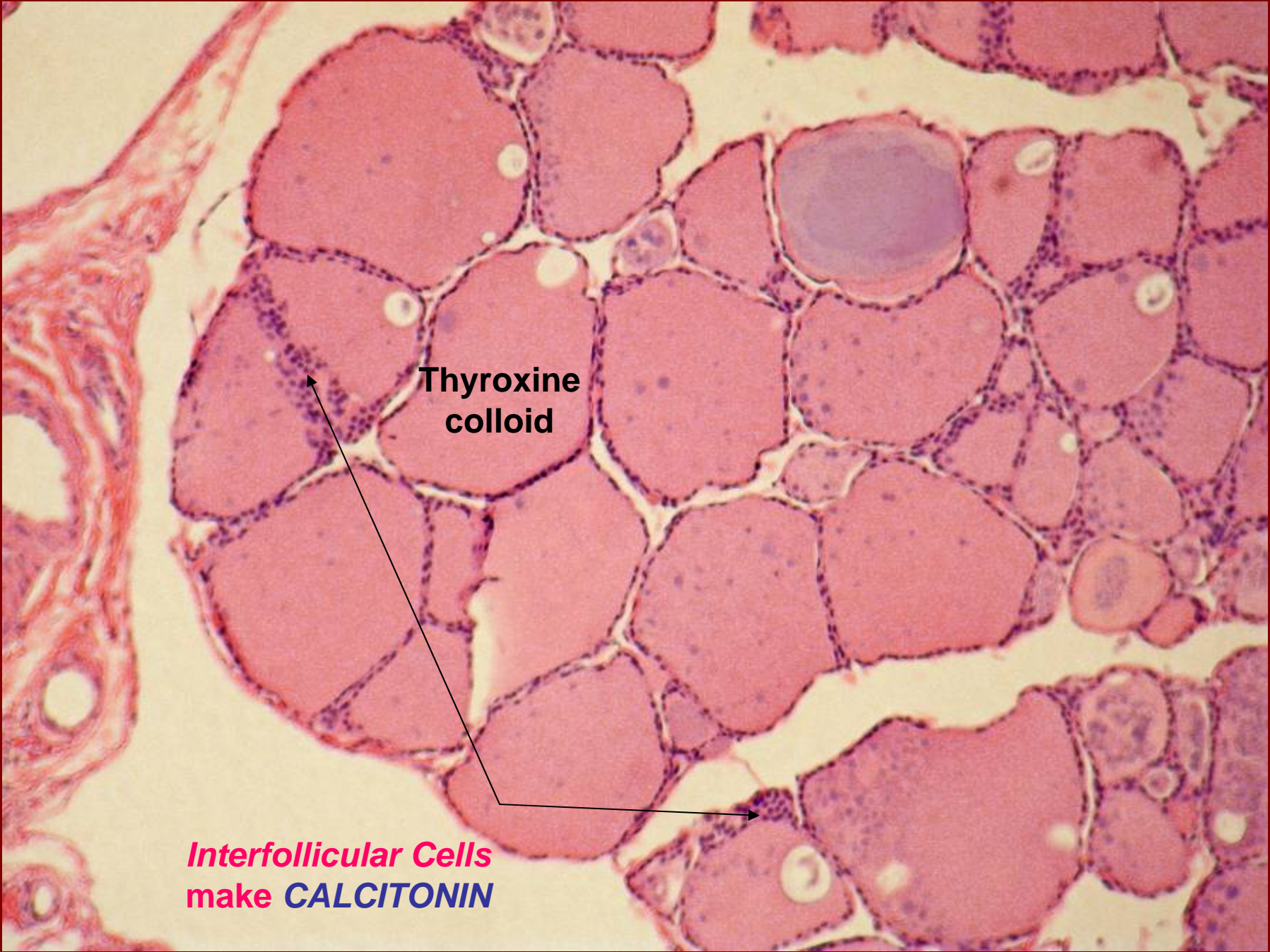
THYROID

Thyroid Artery

Follicle w/
COLLOID

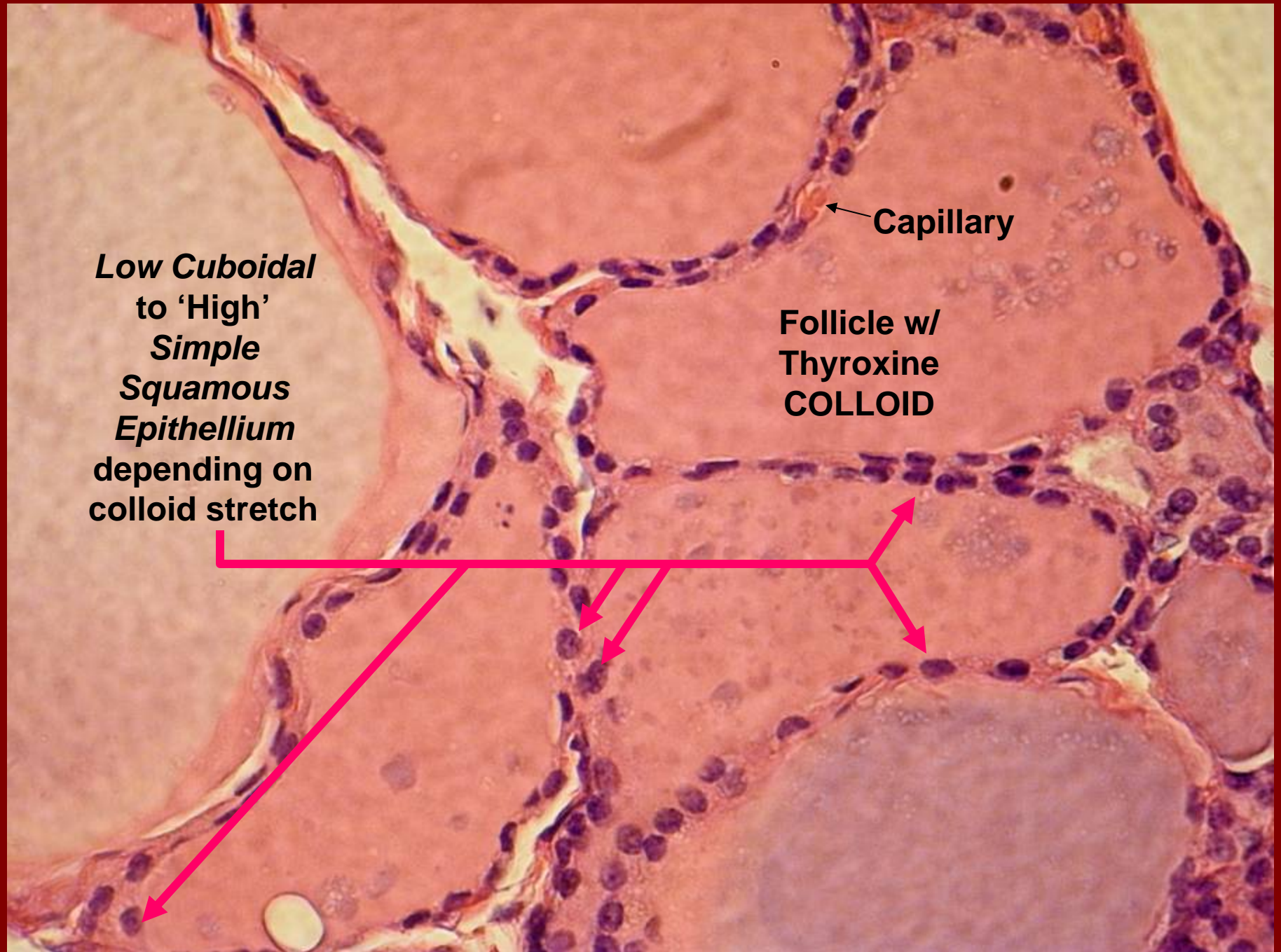
*Interfollicular Cells
make **CALCITONIN***





**Thyroxine
colloid**

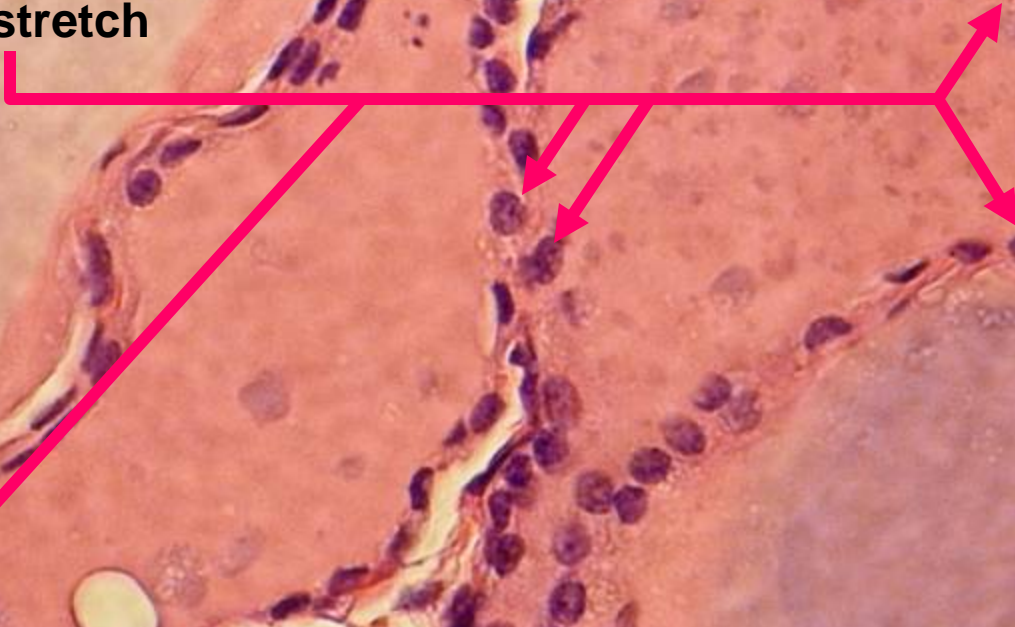
**Interfollicular Cells
make CALCITONIN**



Capillary

*Low Cuboidal
to 'High'
Simple
Squamous
Epithellium
depending on
colloid stretch*

Follicle w/
Thyroxine
COLLOID



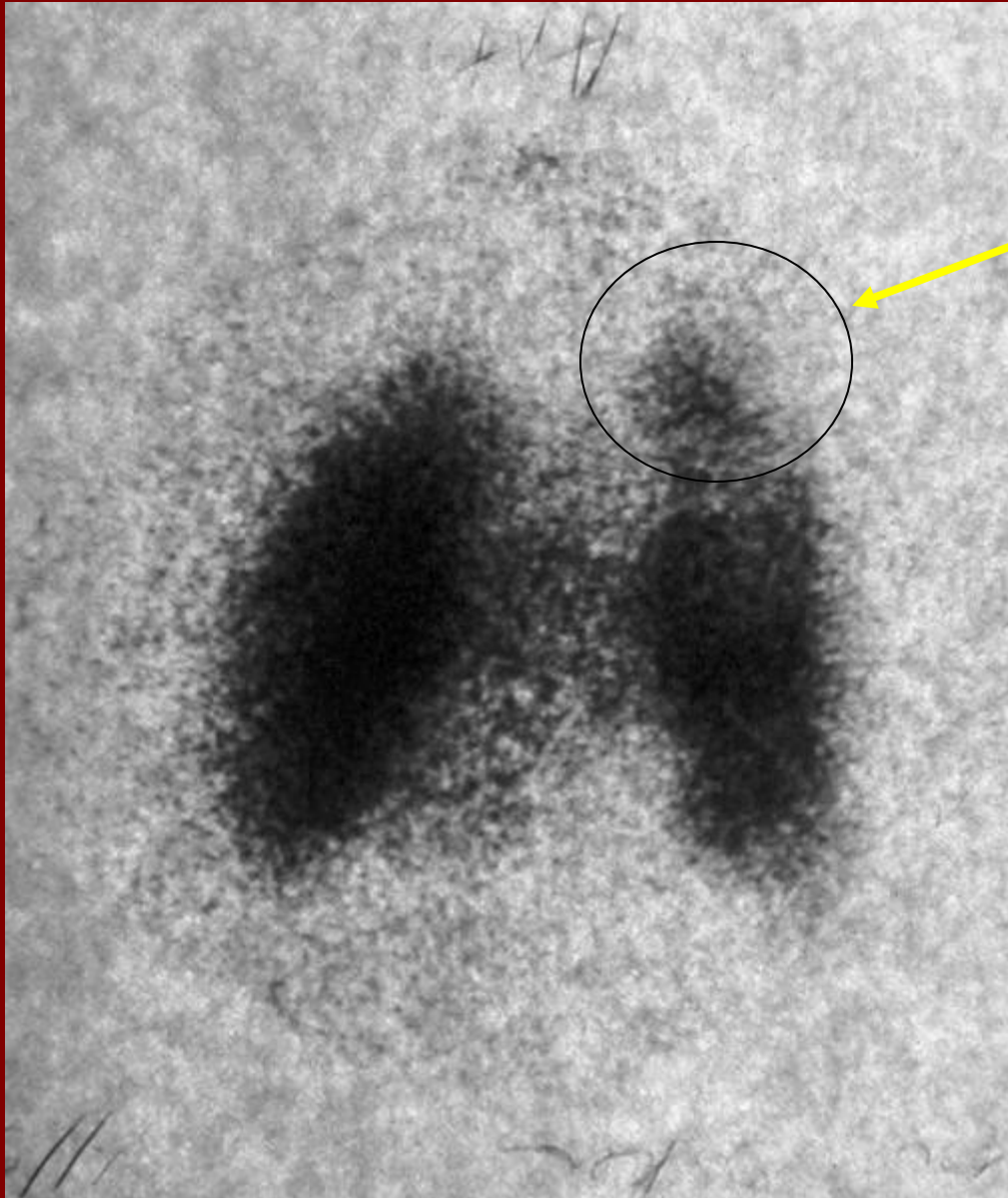
TRH – Thyroid Releasing Hormone - in Hypothalamus released to Ant. Pituitary which then releases TSH - Thyroid Stimulating Hormone – which goes to Thyroid Gland :

T3 (Triiodothyroxine w/ 3 I atoms) & T4 (Thyroxine in liver adds 4th I atom) together increase rate of CATALYSIS of Carbohydrates by Oxidation in Mitochondria of Body cells; increase rate of Protein Synthesis; and increase Lipid Burning Rate; essential for normal CNS development and normal growth rate.= Regulates Metabolic Rate

Interstitial or Interfollicular cells between Follicles produce CALCITONIN, a hormone which, when Blood Ca⁺⁺ is High, & PTH is Low is released. This inhibits Osteoclasts resorbing bone & increases urinary excretion of Ca⁺⁺ & PO₄. = works along with Parathyroid to homeostatically regulate Calcium.

Problems: 1) Hyperthyroidism (Grave's Disease) – an autoimmune disease that allows T_SAntibodies to mimic TSH causing overproduction of T₃&T₄: produces 'Goiter" in neck, overactive, shakes, eat constantly, always hot, nervous, hair loss, heart races, Amenorrhea (no period), can't sleep, and Exophthalmia – bulging eyes.. Radioactive Iodine will kill many cells and some antithyroid drugs available

2) Hypothyroidism (Hashimoto's Disease) – Sluggish, sleep a lot, cool-dry skin, gain weight, depression. Take Synthroid



'Nodule'- injection of radioactive iodine & film placed on neck allows thyroid to take it's own picture

Surgical Hypothyroidism (Hashimoto's Disease) – Sluggish, sleep a lot, cool-dry skin, gain weight, depression. Take Synthroid for LIFE