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Development of Complex Curricula for Molecular Bionics and Infobionics Programs within a consortial* framework**

Consortium leader

PETER PAZMANY CATHOLIC UNIVERSITY

Consortium members

SEMMELWEIS UNIVERSITY, DIALOG CAMPUS PUBLISHER

The Project has been realised with the support of the European Union and has been co-financed by the European Social Fund ***

**Molekuláris bionika és Infobionika Szakok tananyagának komplex fejlesztése konzorciumi keretben

***A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.



Nemzeti Fejlesztési Ügynökség

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TÁMOP – 4.1.2-08/2/A/KMR-2009-0006



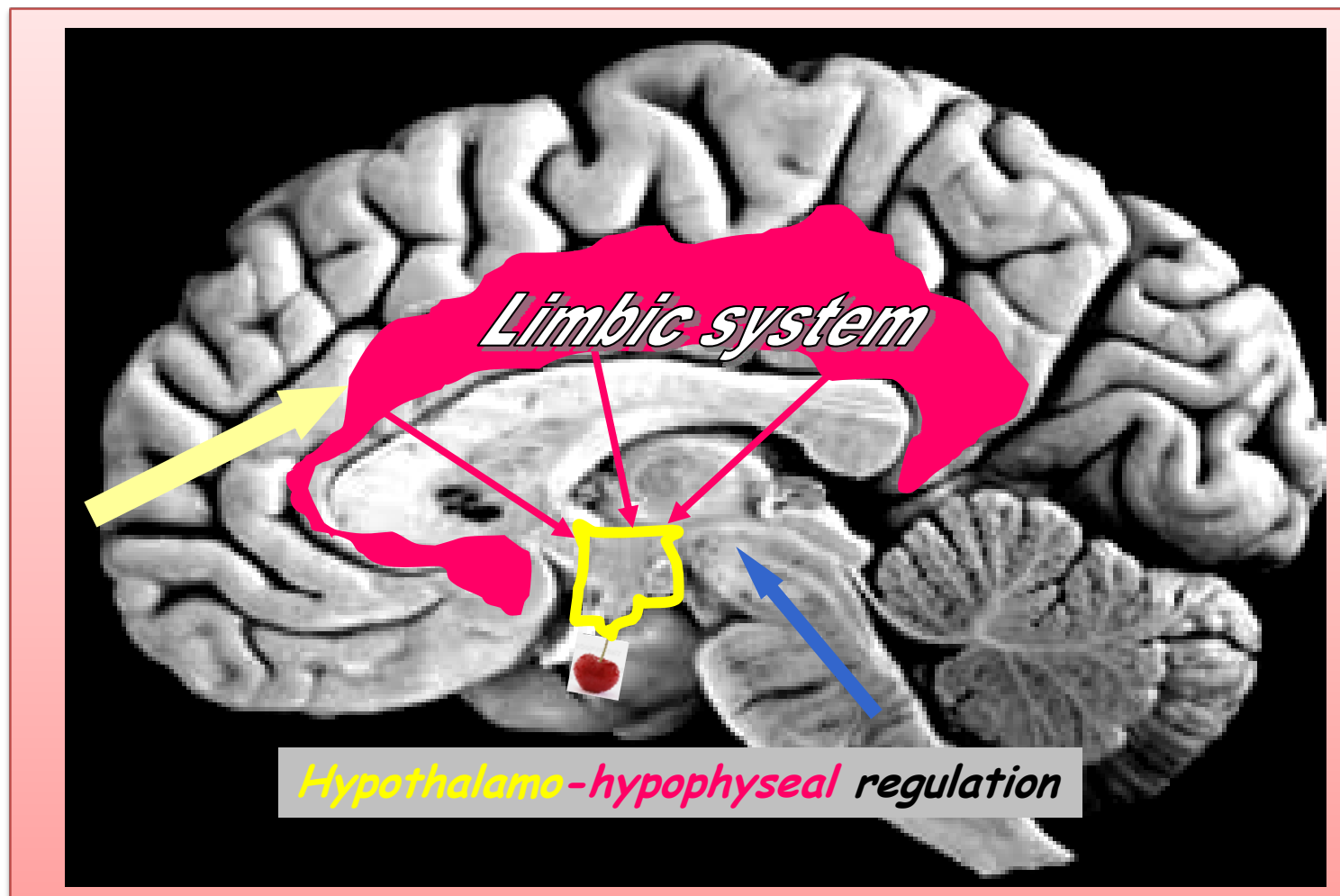
BEVEZETÉS A FUNKCIONÁLIS NEUROBIOLÓGIÁBA

INTRODUCTION TO FUNCTIONAL NEUROBIOLOGY

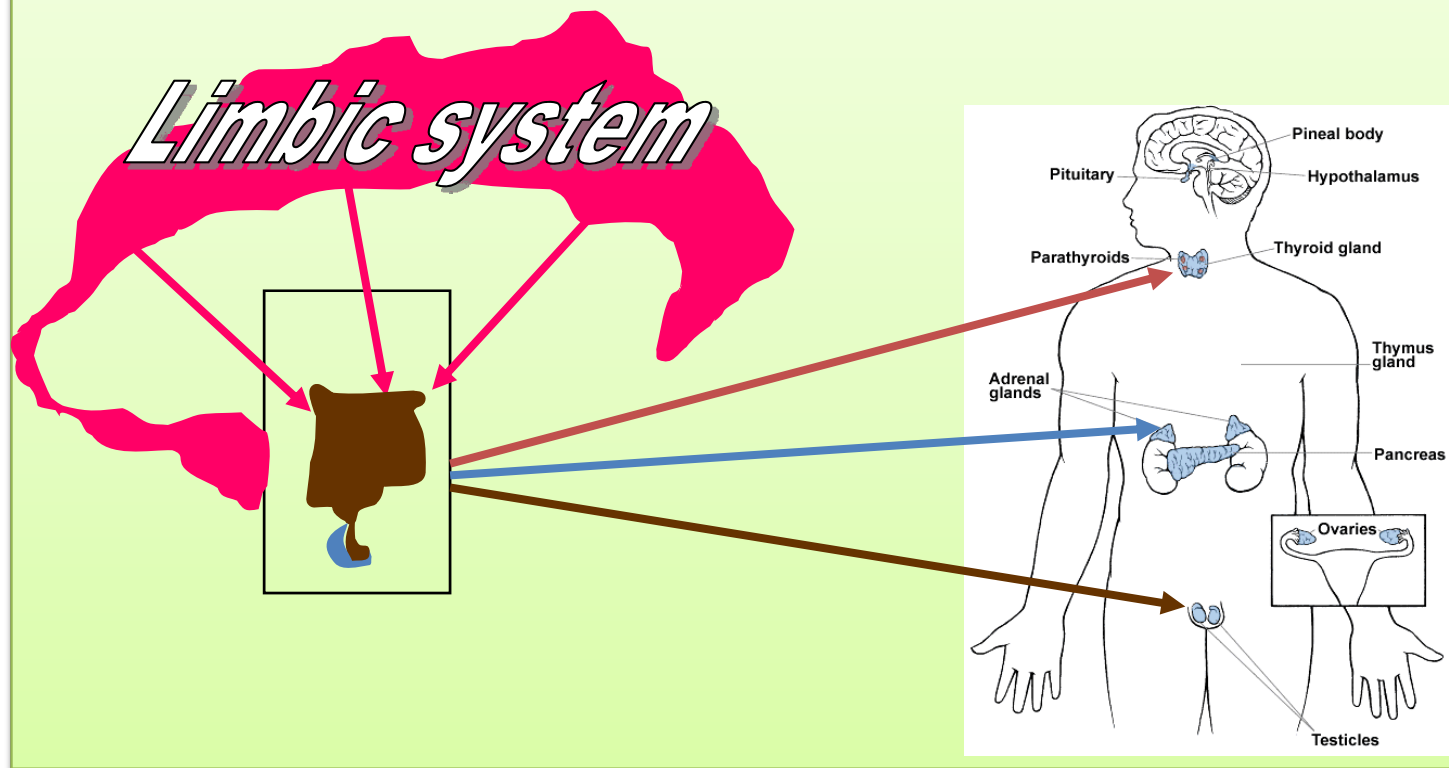
THE NEUROENDOCRINE HYPOTHALAMUS

(A neuroendokrin hypothalamus)

ZSOLT LIPOSITS

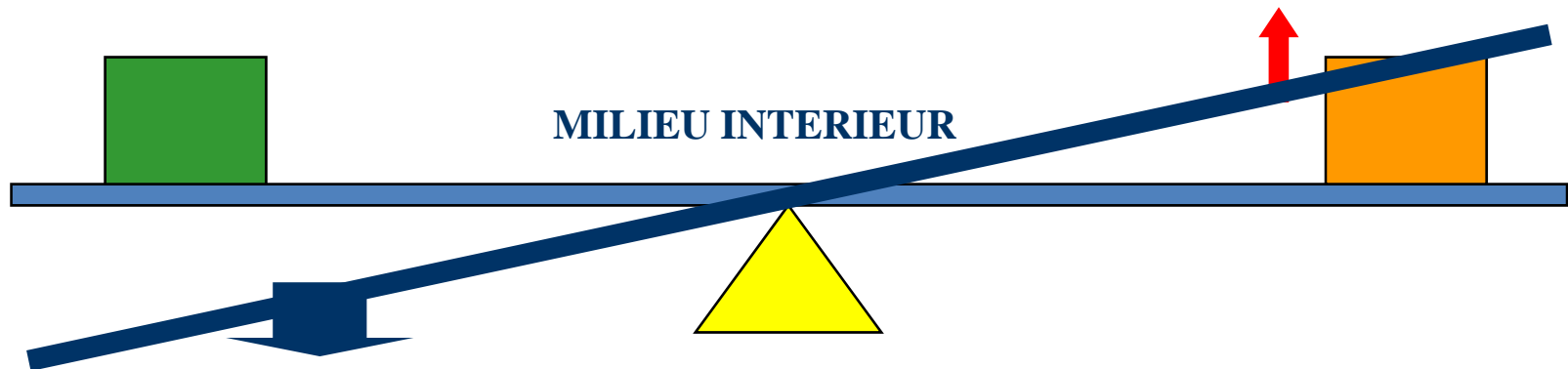


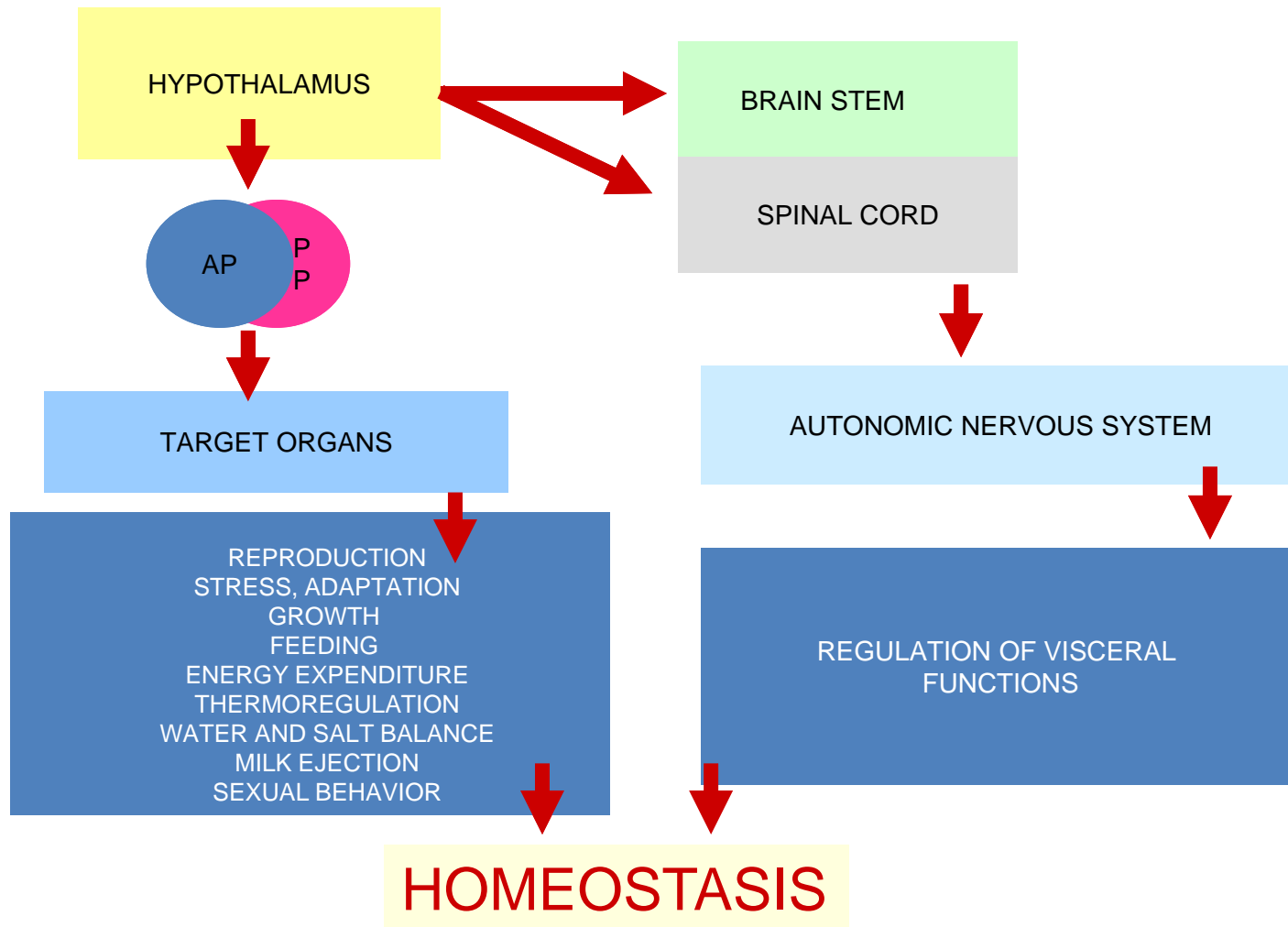
Hypothalamo-pituitary unit



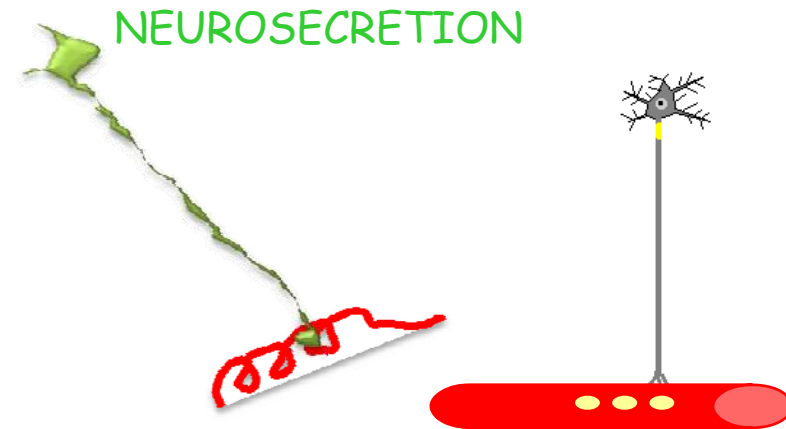
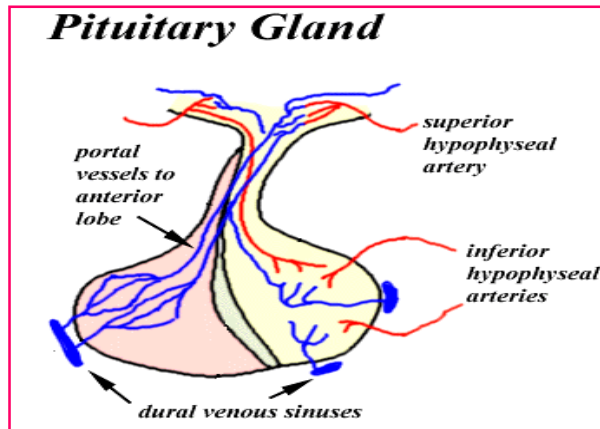
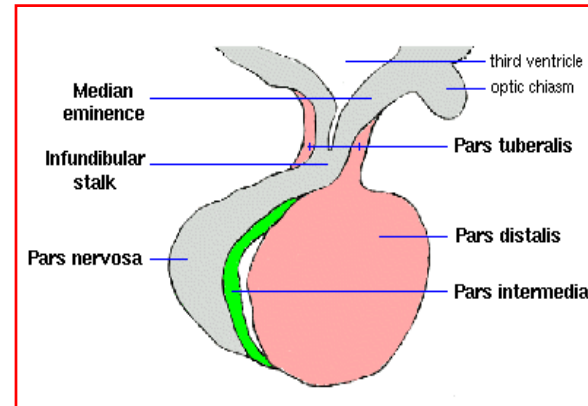
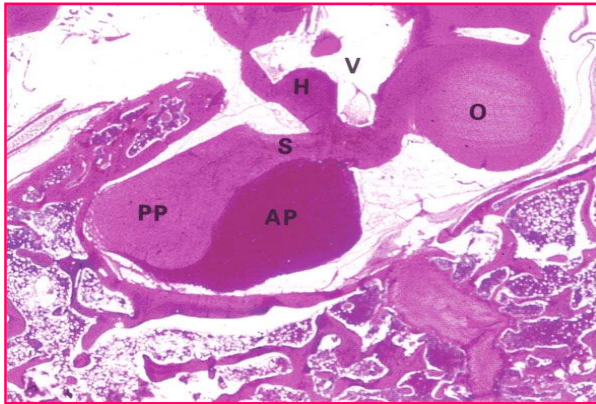
Significance of the endocrine system

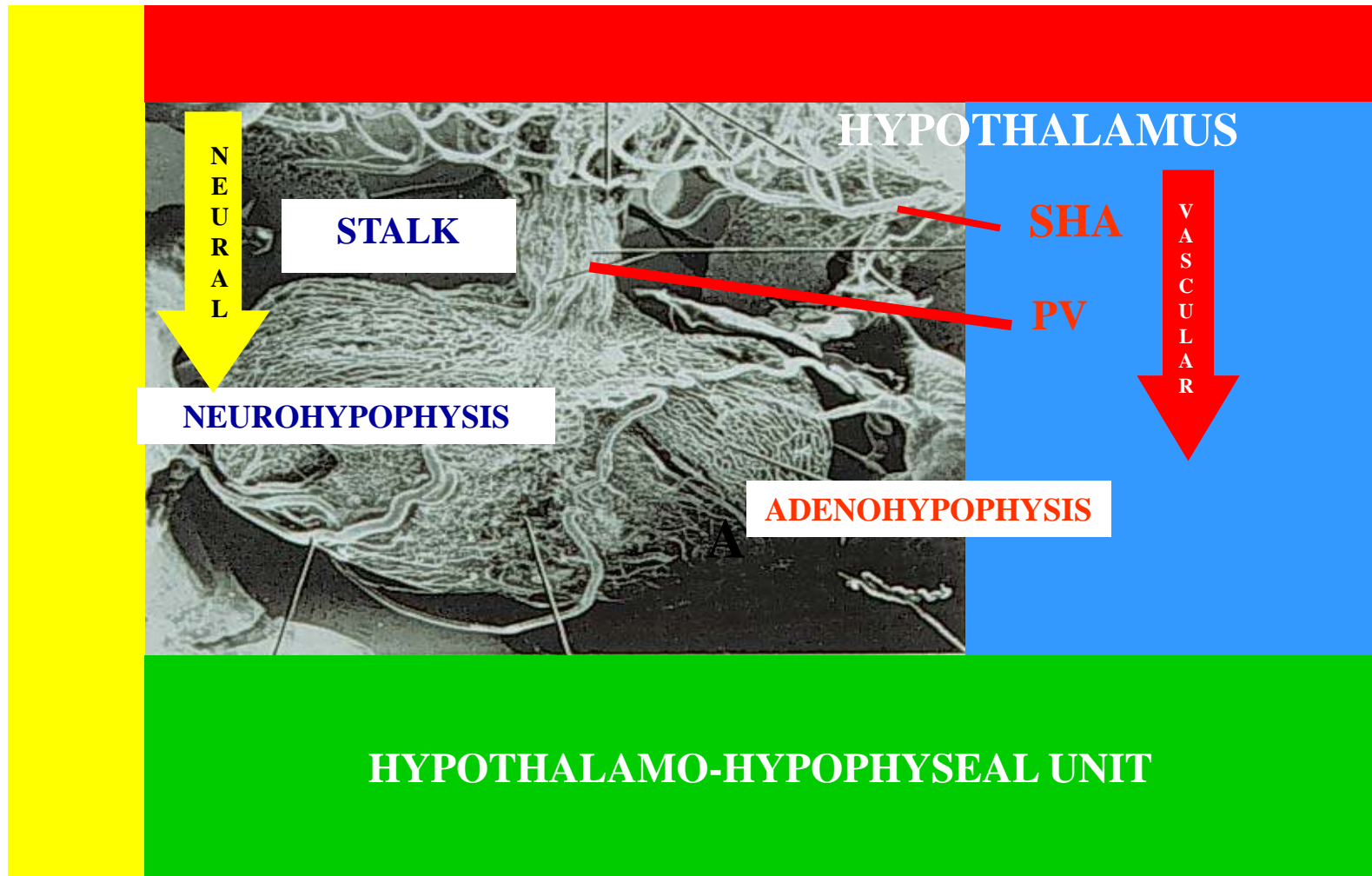
HPG- system	Reproduction	Sterility
HPT- system	Metabolism	Graves disease
HPA-system	Adaptation	Addison disease
HPP-system	Water, salt balance	Diabetes insipidus
Endocrine pancreas	Carbohydrate metabolism	Diabetes mellitus

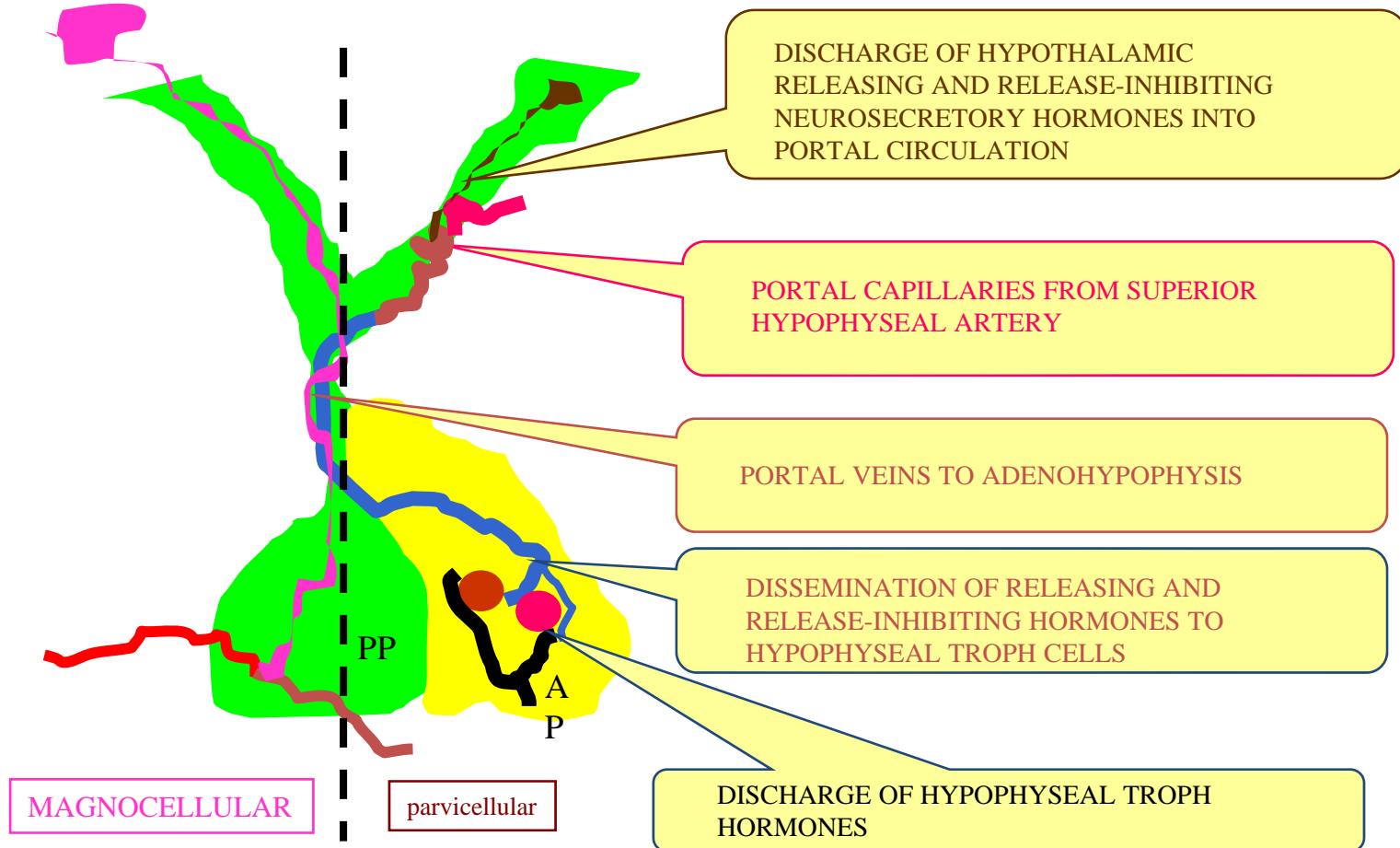


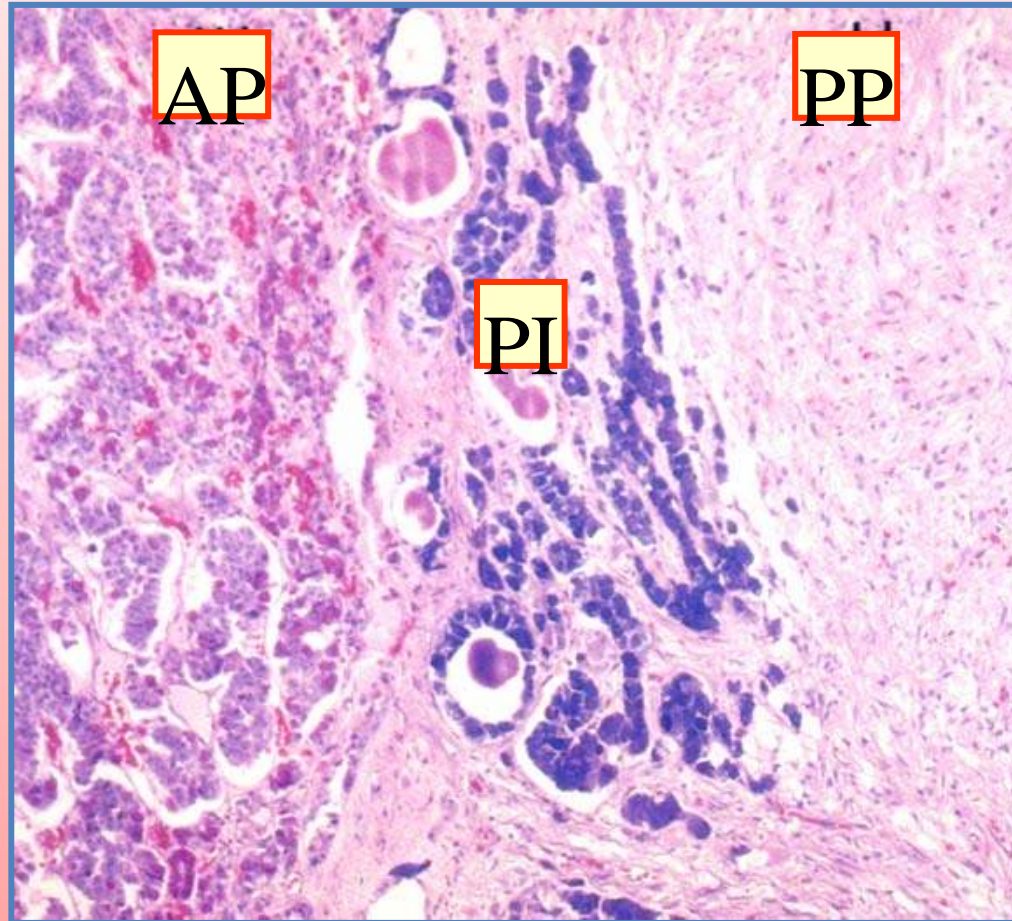


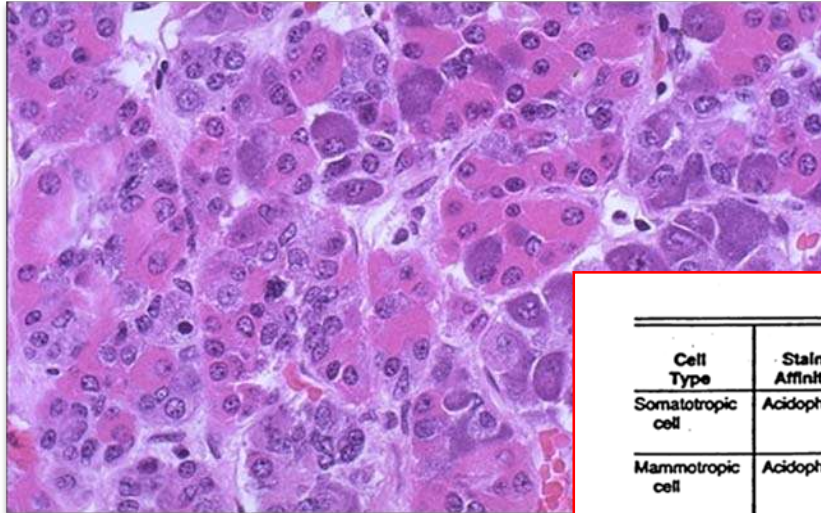
BLOOD SUPPLY, NEUROSECRETION



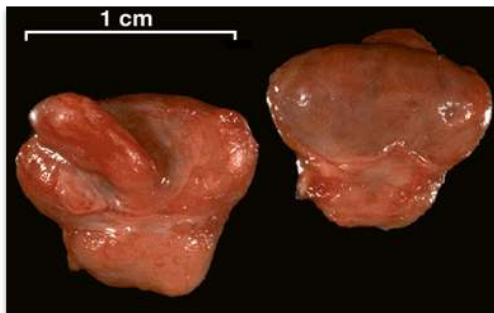








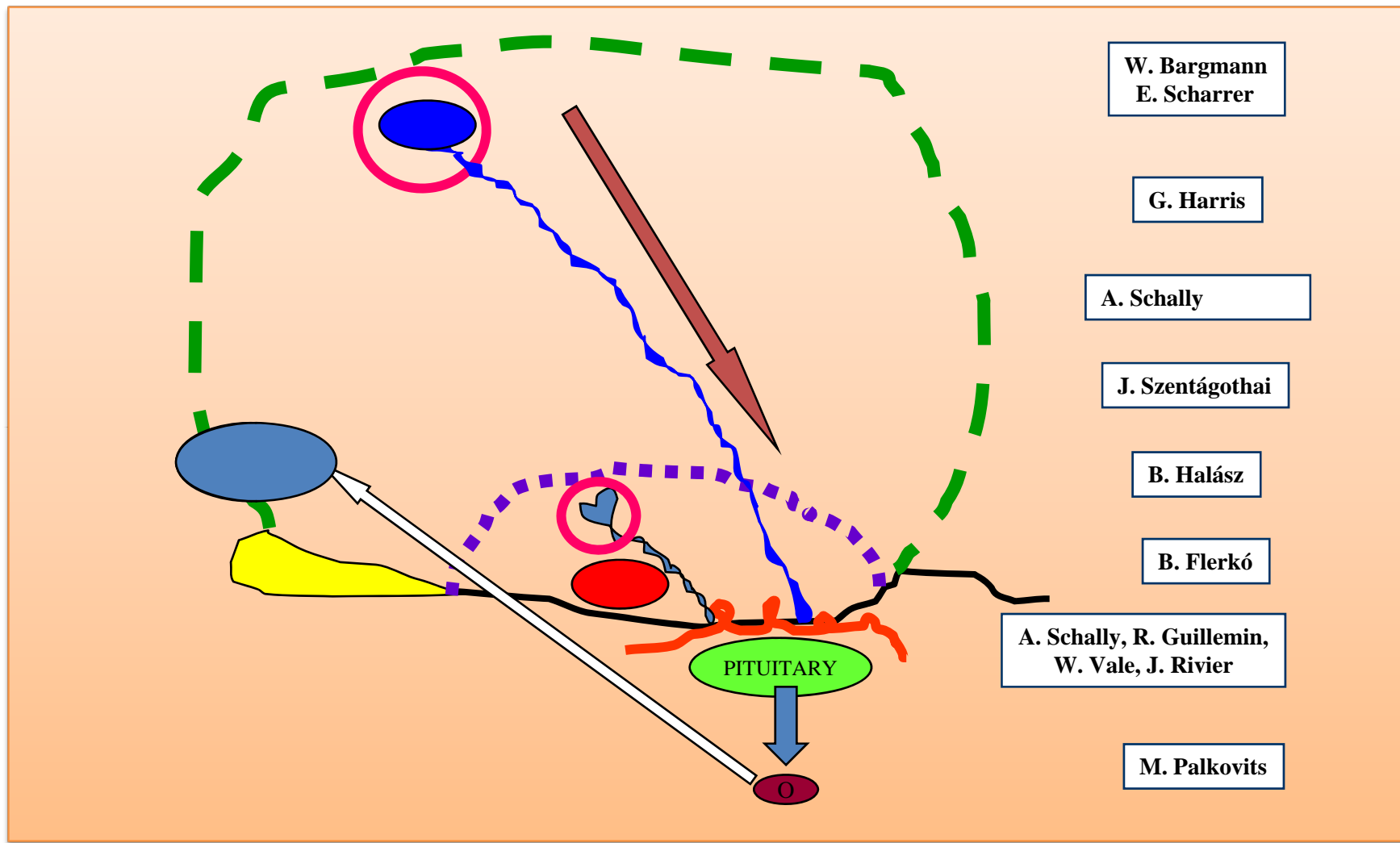
HYPOPHYSEAL HORMONES

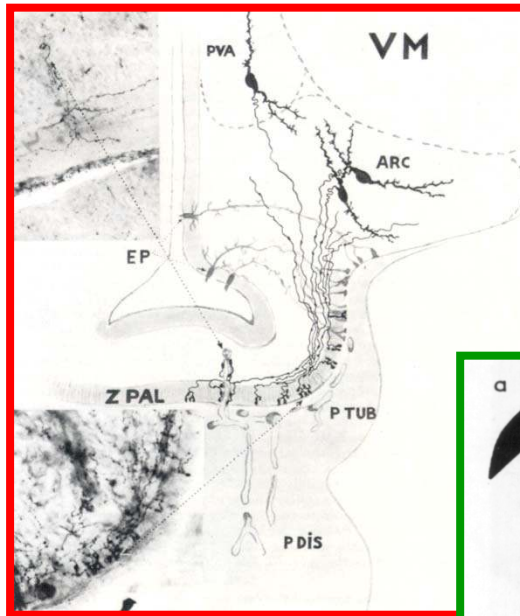


Cell Type	Stain Affinity	Hormone Produced	Main Physiologic Activity	Secretory Granules in Humans	Hypothalamic Releasing Hormones	Hypothalamic Inhibiting Hormones
Somatotropic cell	Acidophilic	Somatotropin (growth hormone).	Acts on growth of long bones via somatomedins synthesized in liver.	Numerous, round or oval; 300–400 nm diameter.	Somatotropin-releasing hormone (SRH).	Somatostatin.
Mammotropic cell	Acidophilic	Prolactin.	Promotes milk secretion.	200 nm; increases in size during pregnancy and lactation (600 nm).	Prolactin-releasing hormone (PRH).	Prolactin-inhibiting hormone (PIH).
Gonadotropic cell	Basophilic	Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) in same cell type.	FSH promotes ovarian follicle development and estrogen secretion in female and stimulates spermatogenesis in male. LH promotes ovarian follicle maturation and progesterone secretion in female, Leydig cell stimulation and androgen secretion in male.	250–400 nm.	Gonadotropin-releasing hormone (GnRH). According to some authors there are 2 releasing hormones: FRH and LRH (follicle- and lutein-releasing, respectively).	
Thyrotropic cell	Basophilic	Thyrotropin (TSH).	Stimulates thyroid hormone synthesis, storage, and liberation.	Small granules, 120–200 nm.	Thyrotropin-releasing hormone (TRH).	
Corticotropic cell	Basophilic	Corticotropin (ACTH).	Stimulates secretion of adrenal cortex hormones.	Large granules, 400–550 nm.	Corticotropin-releasing hormone (CRH).	

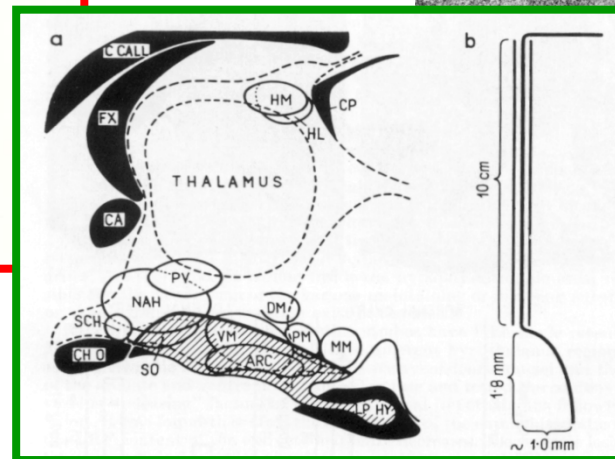
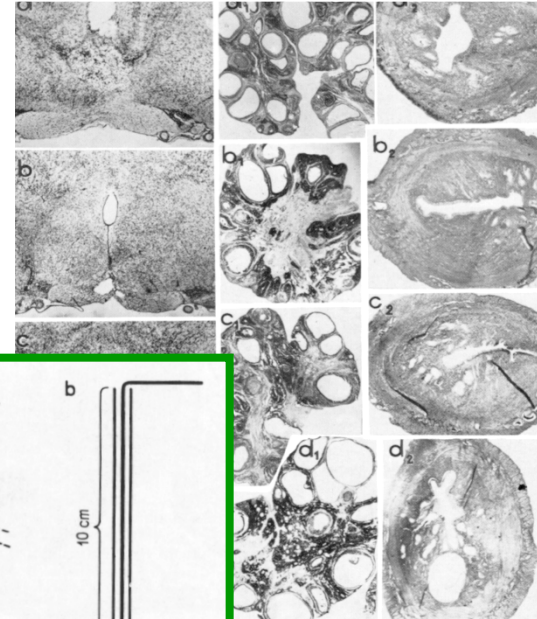
INTRODUCTION TO FUNCTIONAL NEUROBIOLOGY

The neuroendocrine hypothalamus

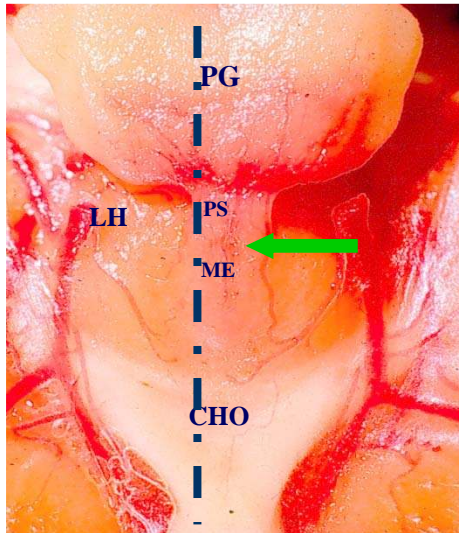




PÉCS



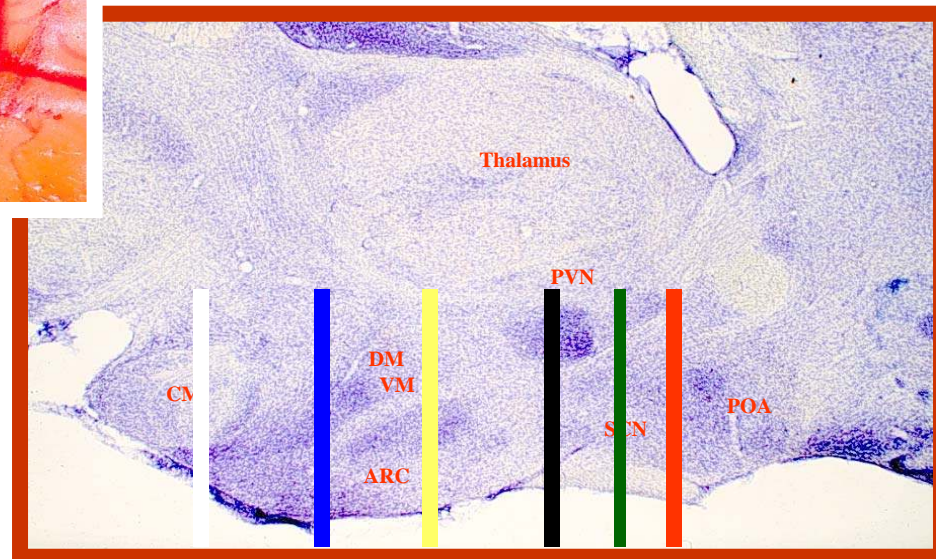
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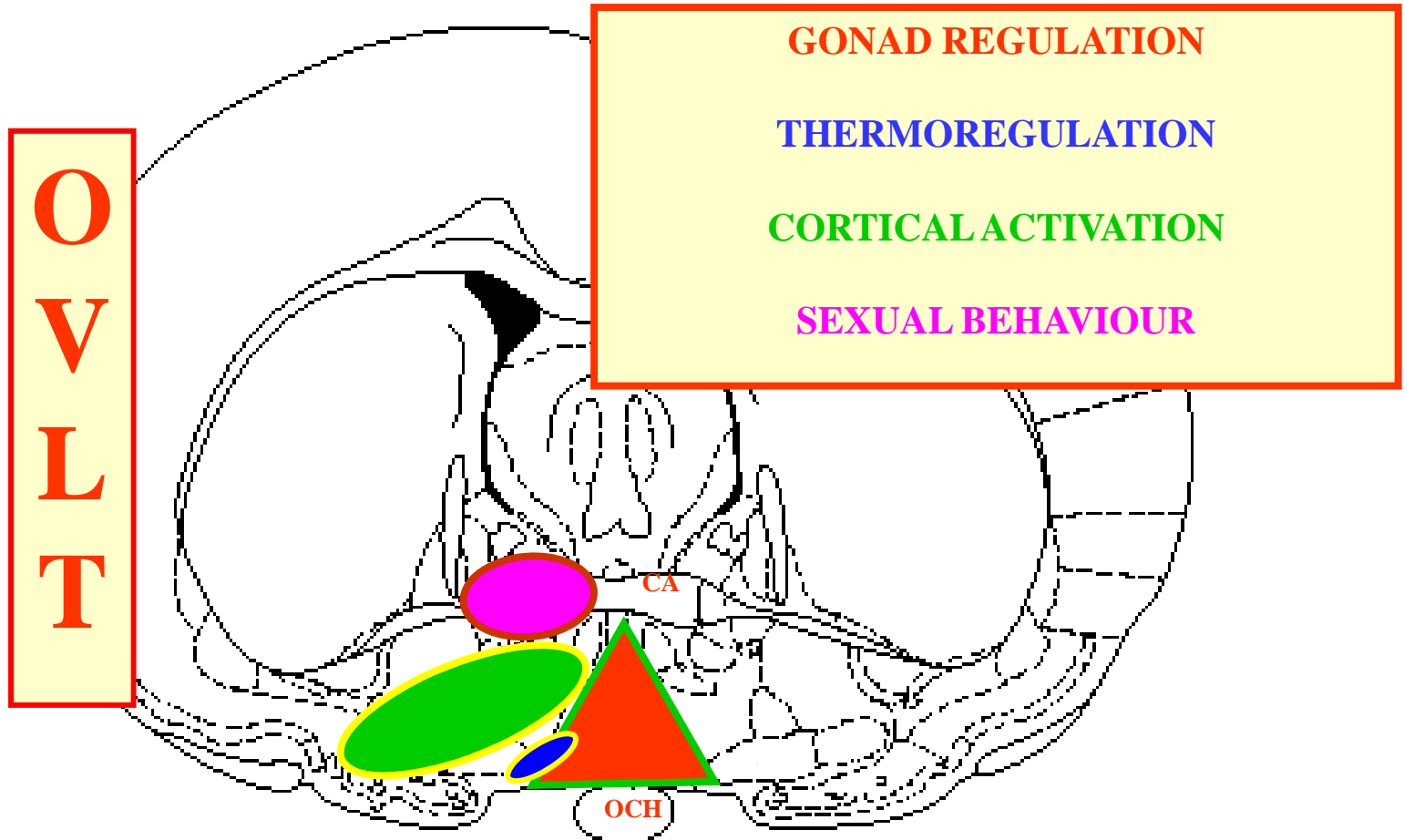


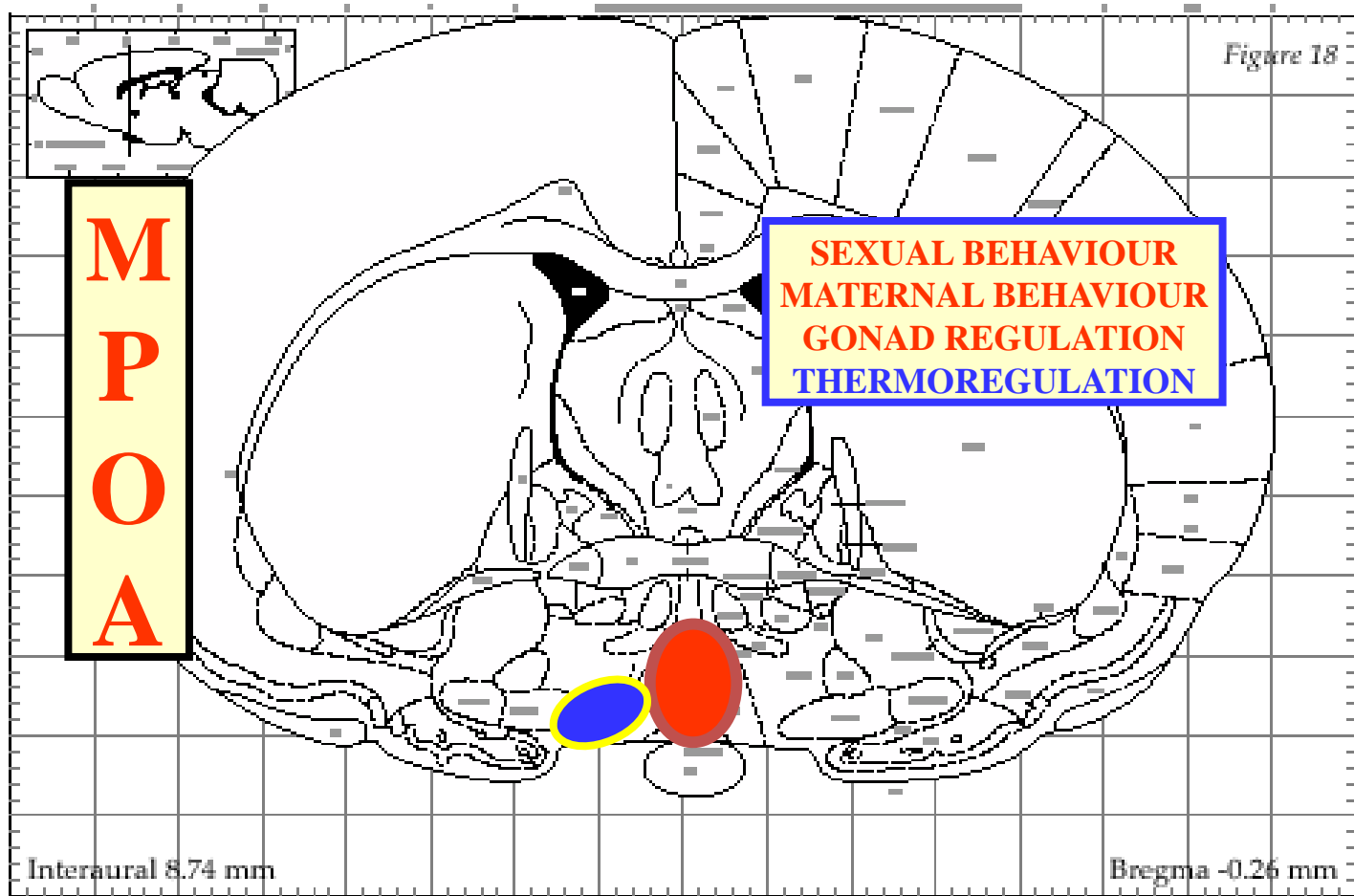
Anterior

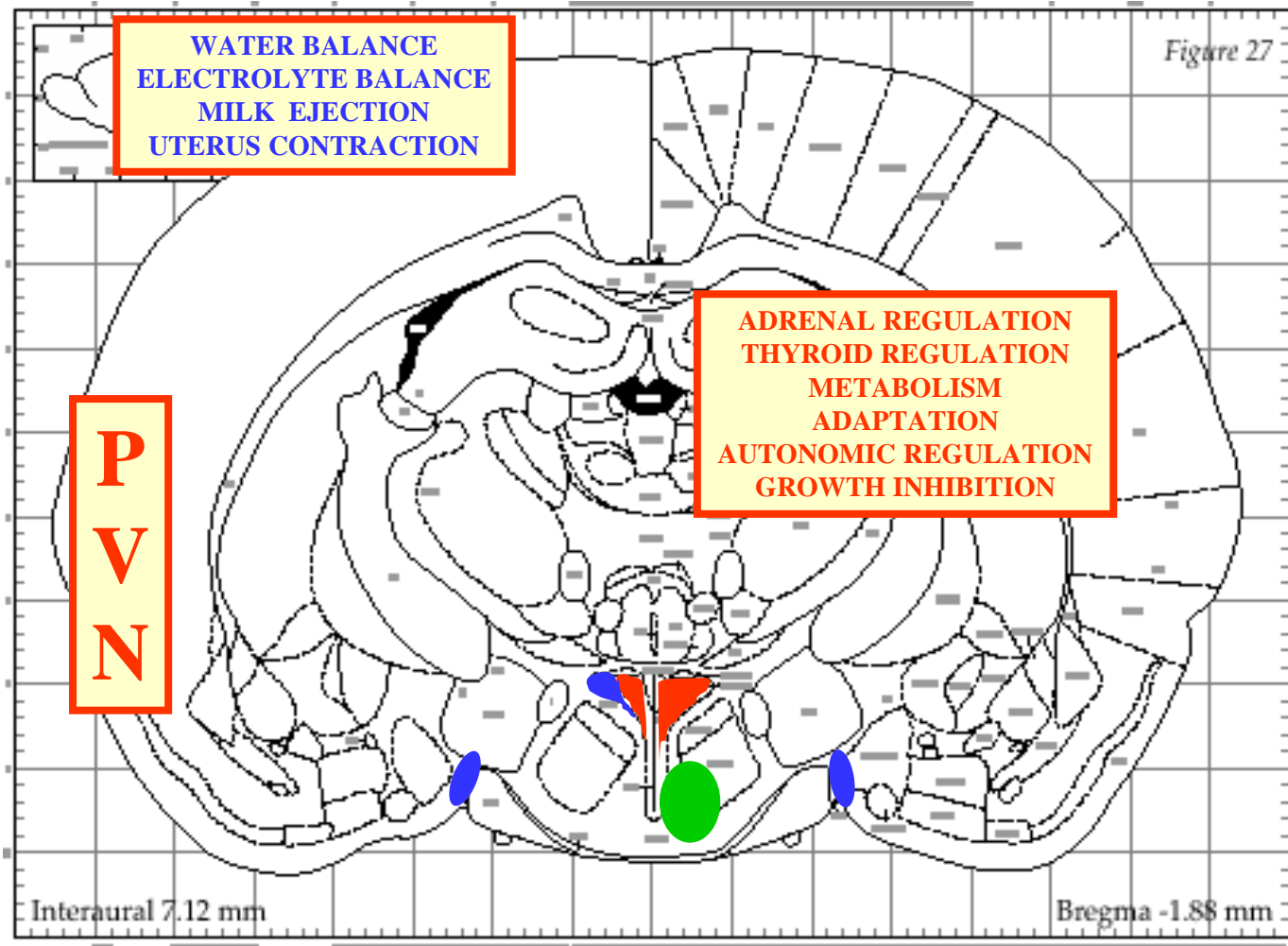


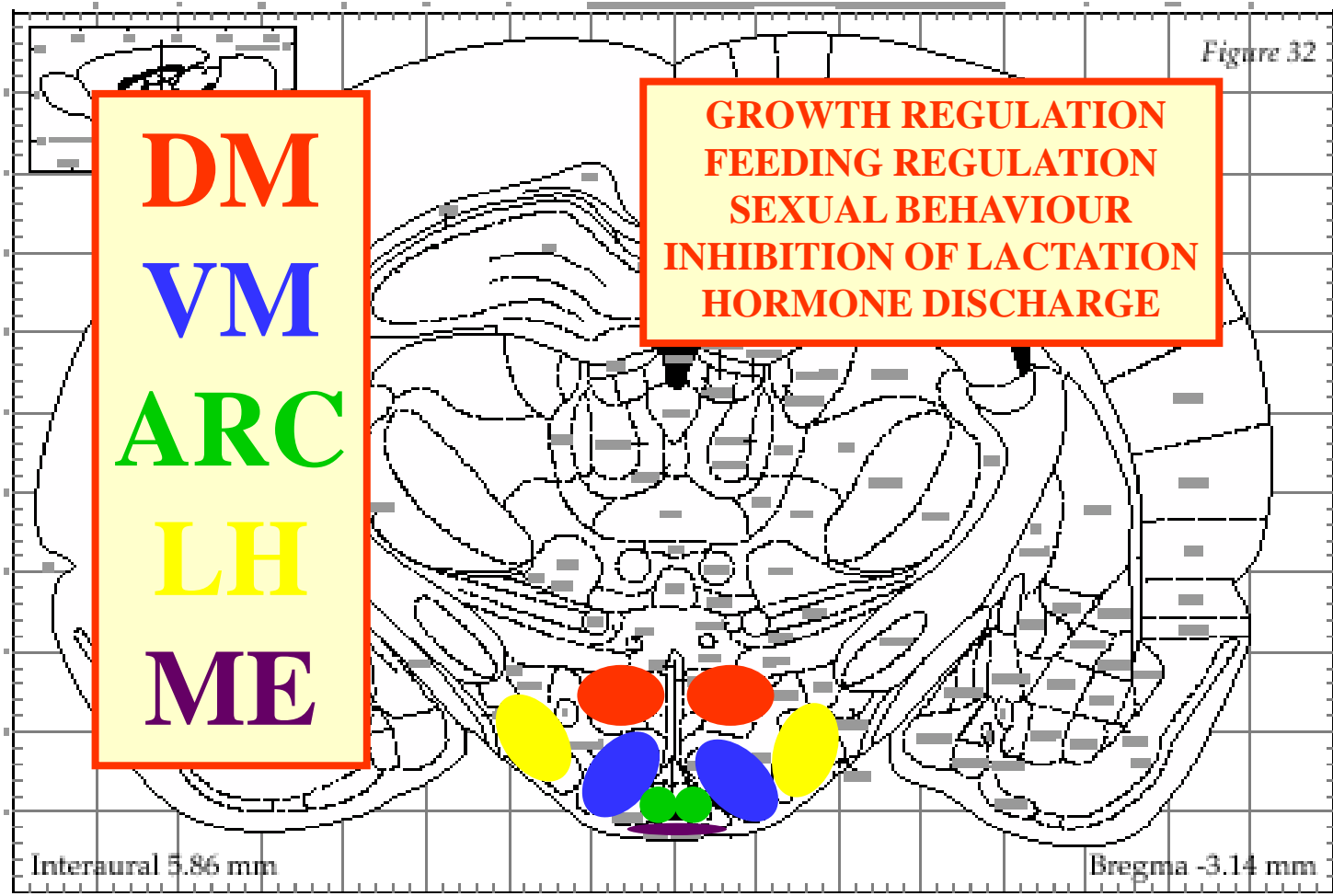
Rat

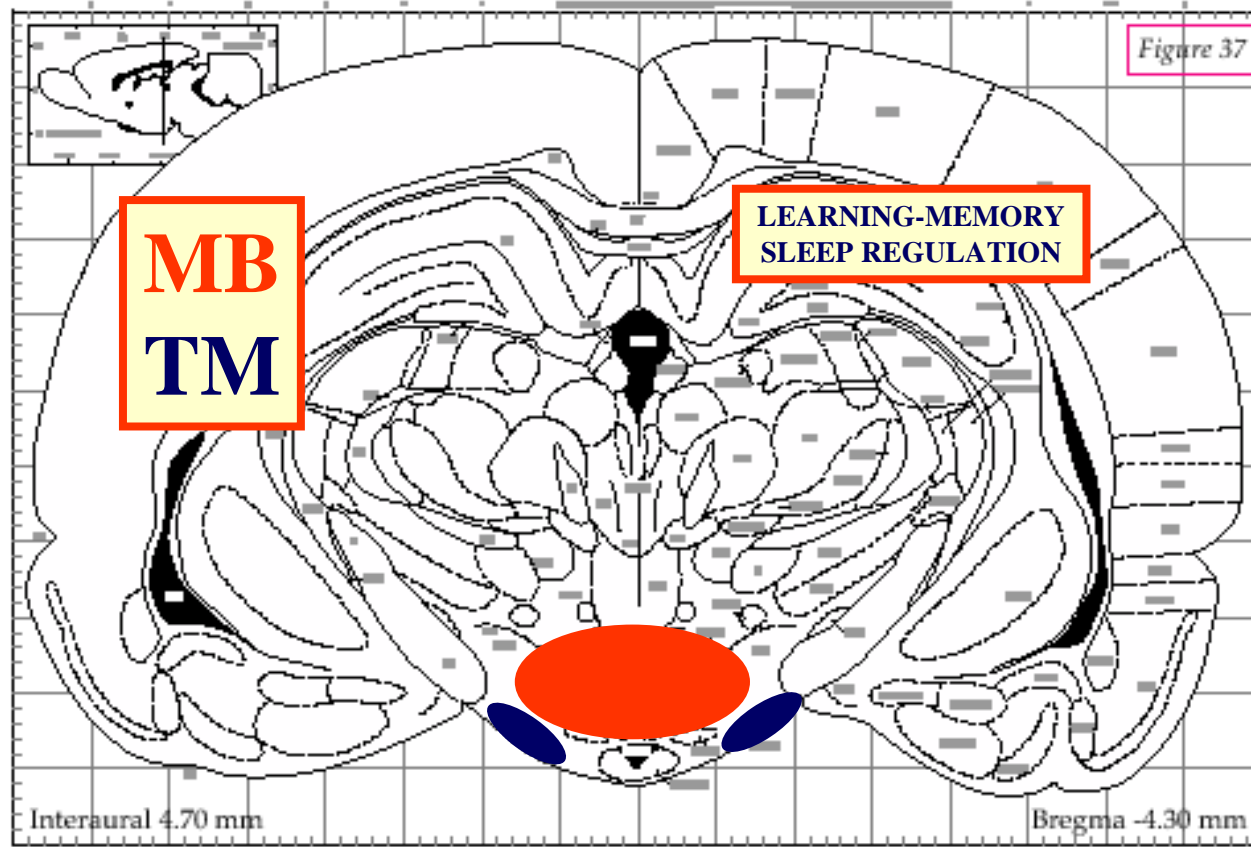










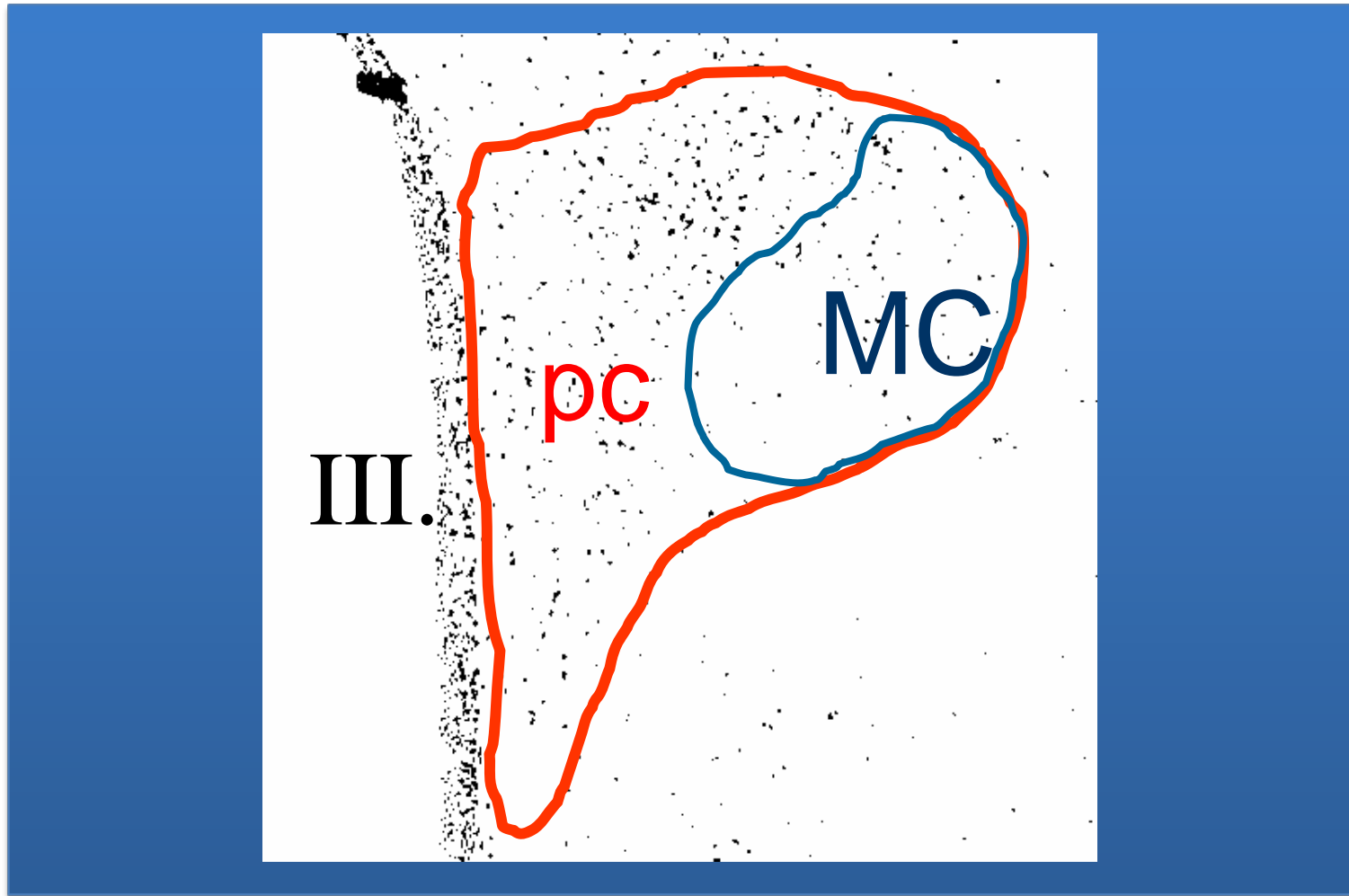


PVN ANTERIOR

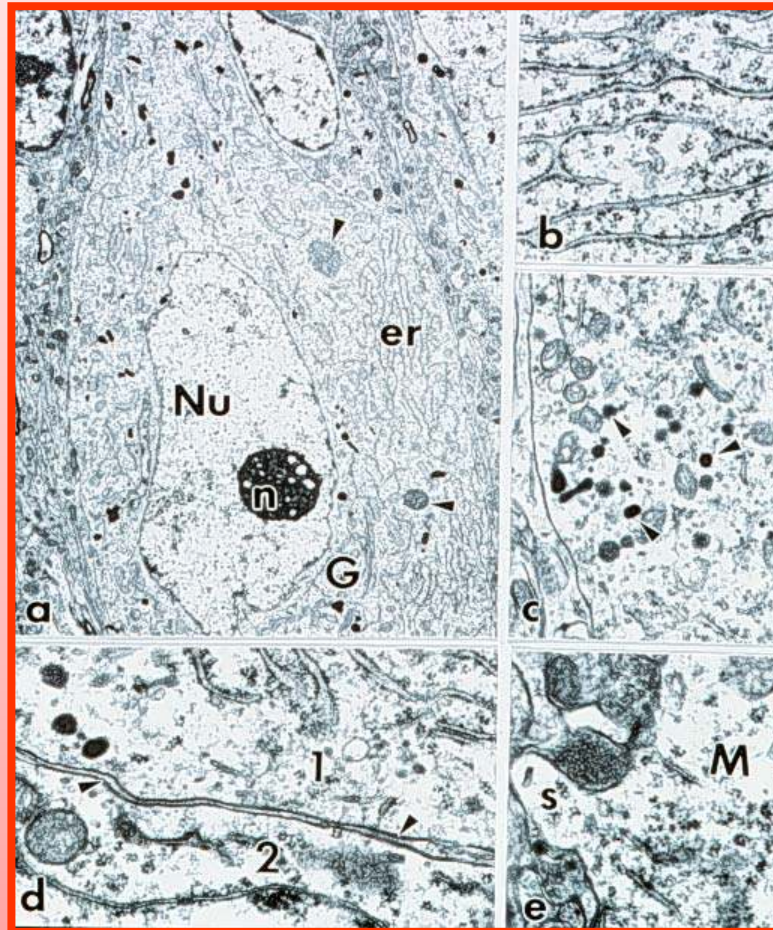
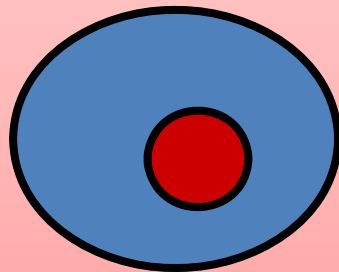
POSTERIOR SUBNUCLEI

ACCESSORY

SON



MC



Vasopressin (antidiuretic hormone, ADH)

Blood vessels: vasoconstriction via **V1a** receptors

Anterior pituitary: ACTH release via **V1b** receptors

Kidney: sodium and water reabsorption via **V2** receptors

Brain: neuromodulation

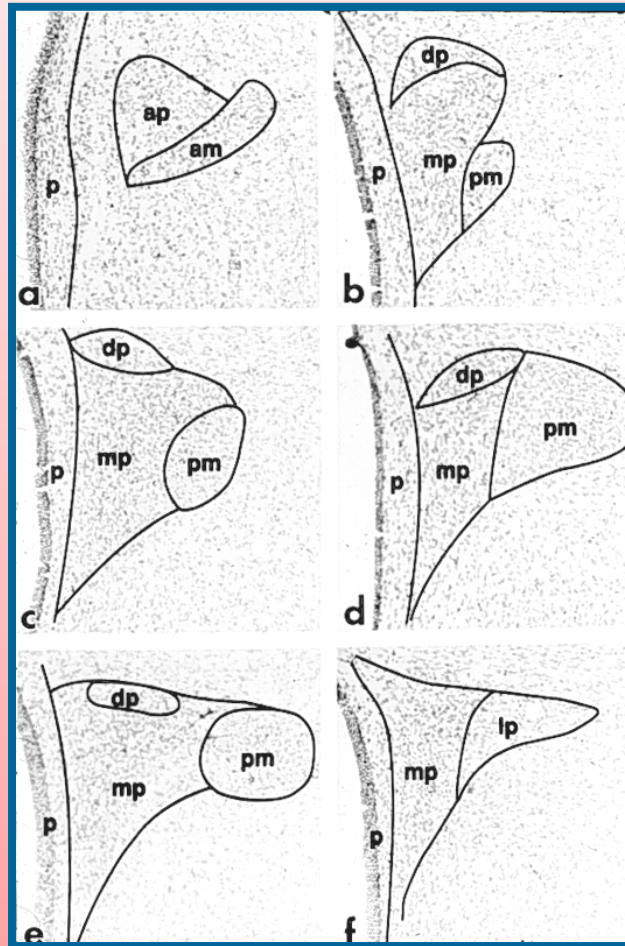
Oxytocin

Lactating breast: *milk ejection*

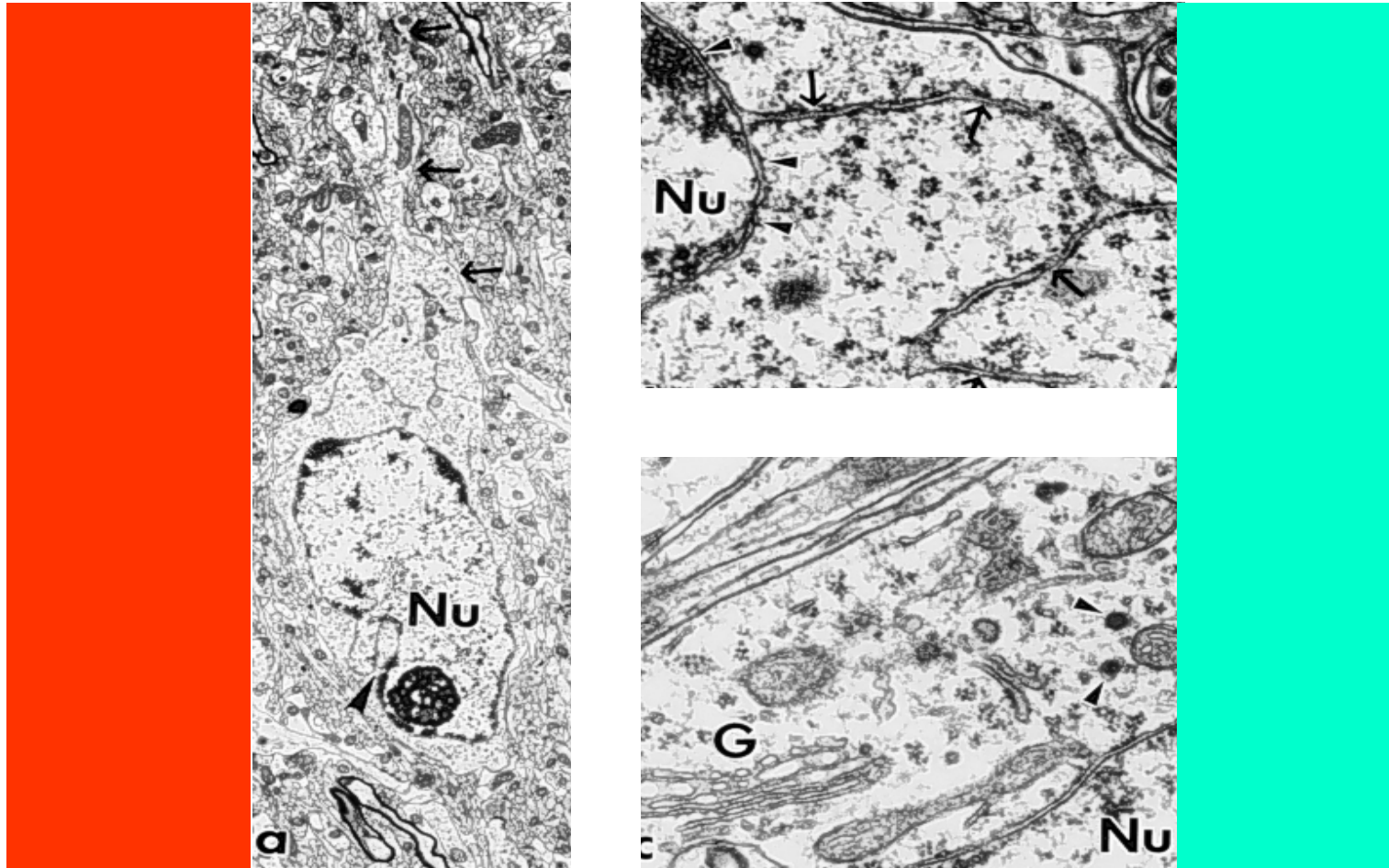
Uterus: *smooth muscle contraction*

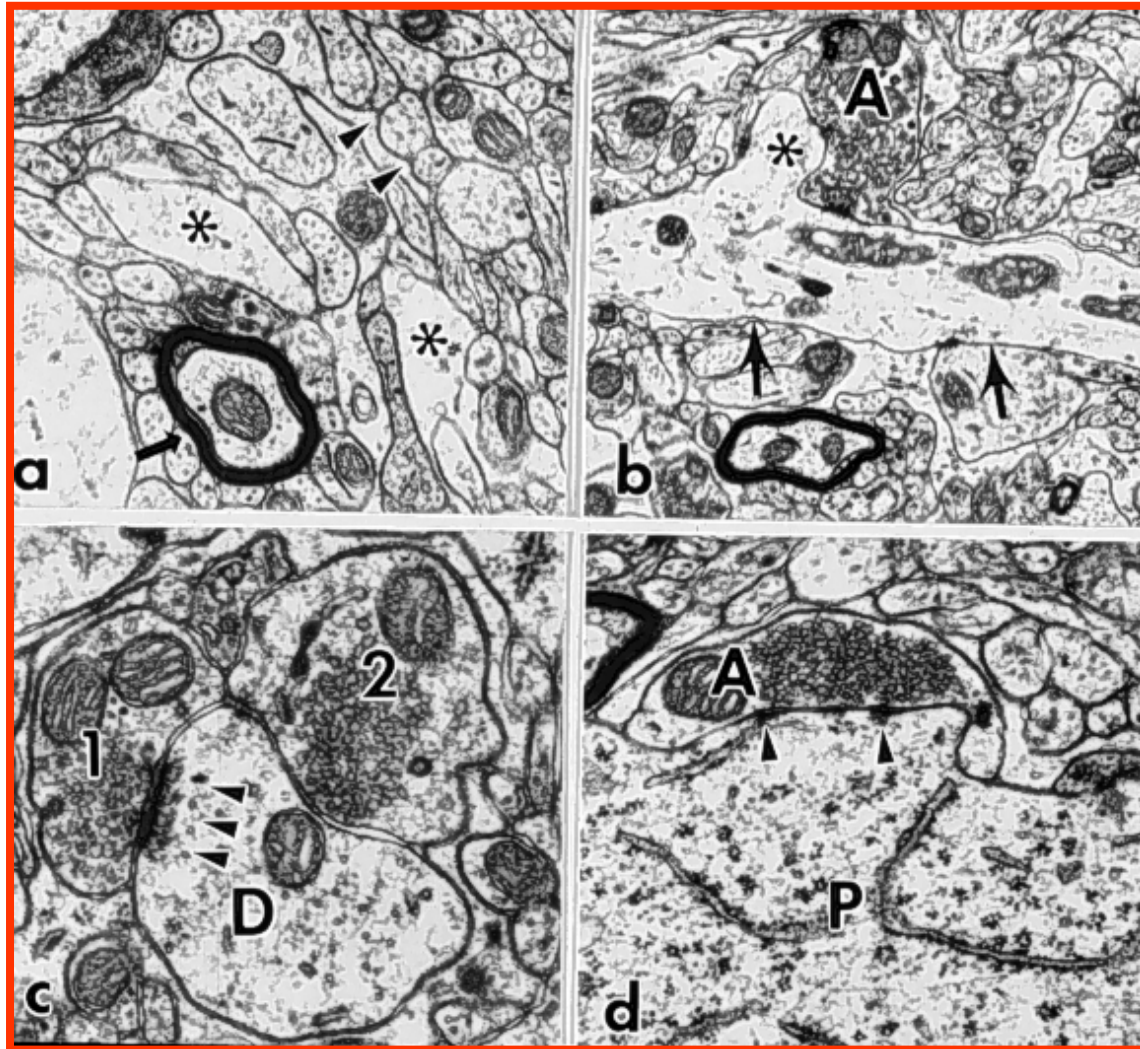
Brain: *neuromodulation*

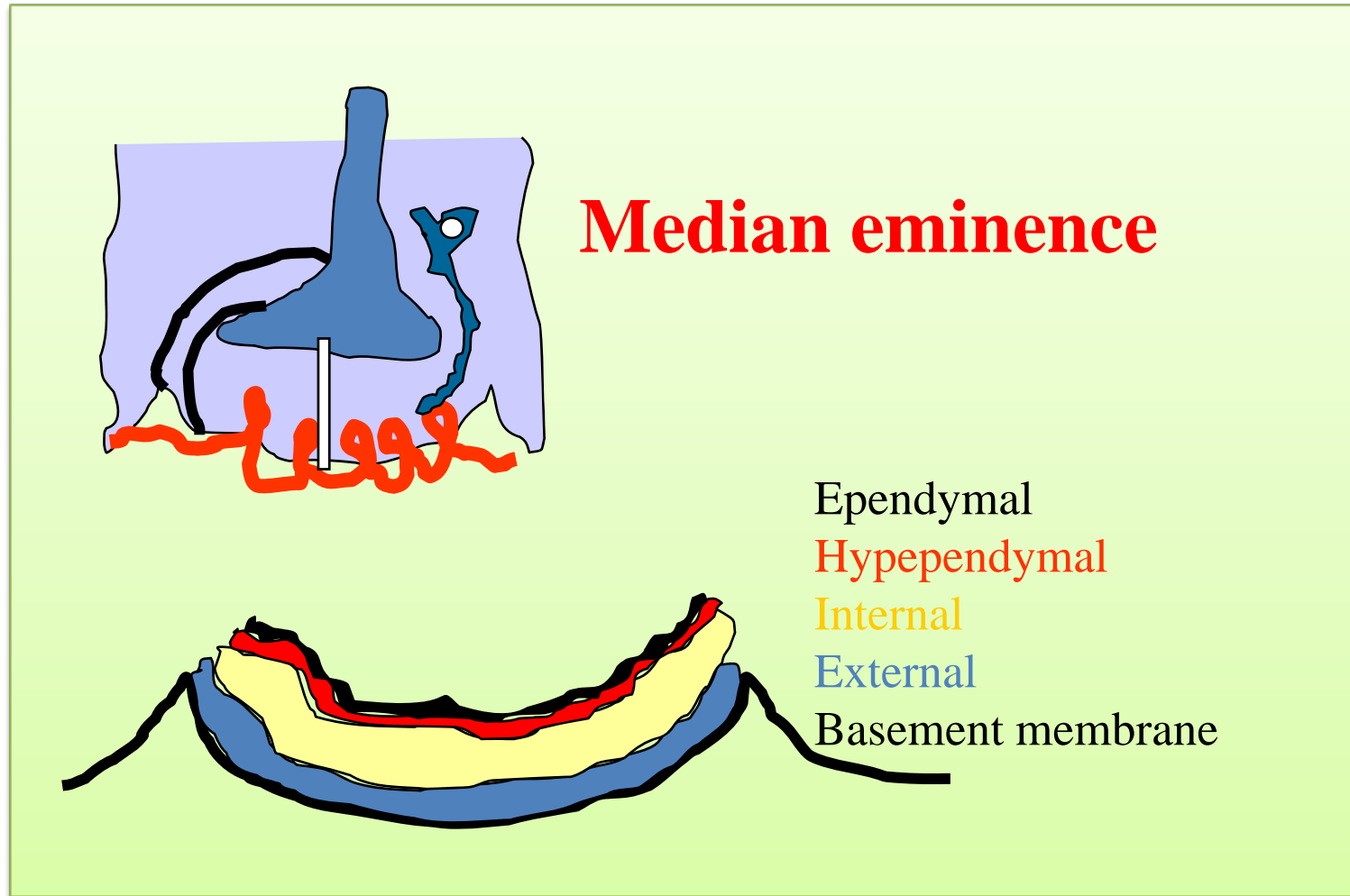
PARVICELLULAR SYSTEM

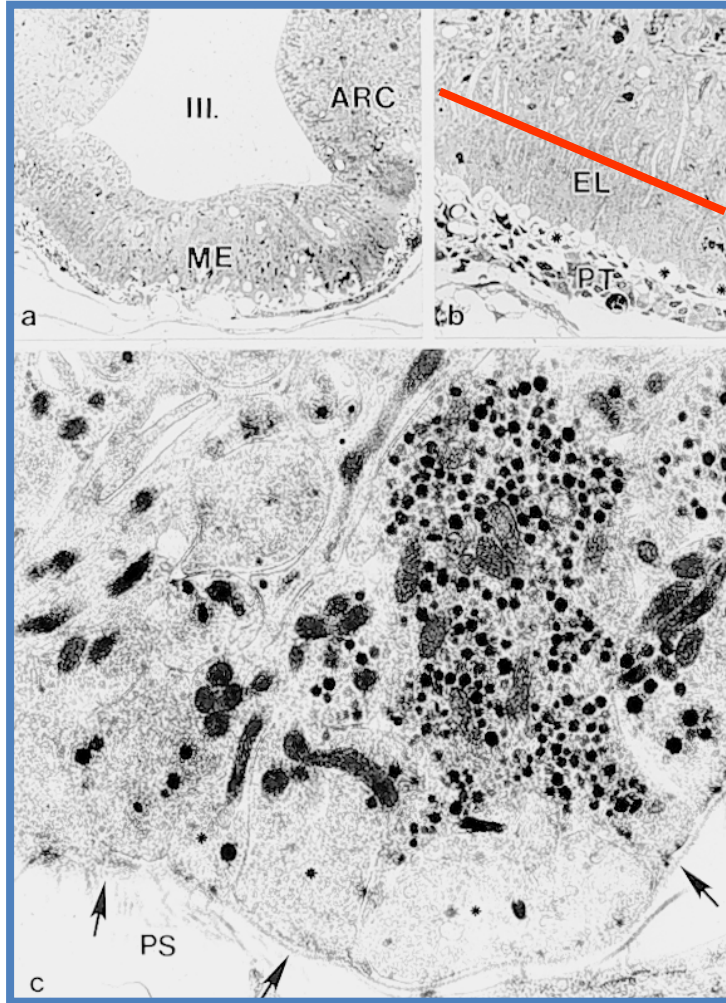


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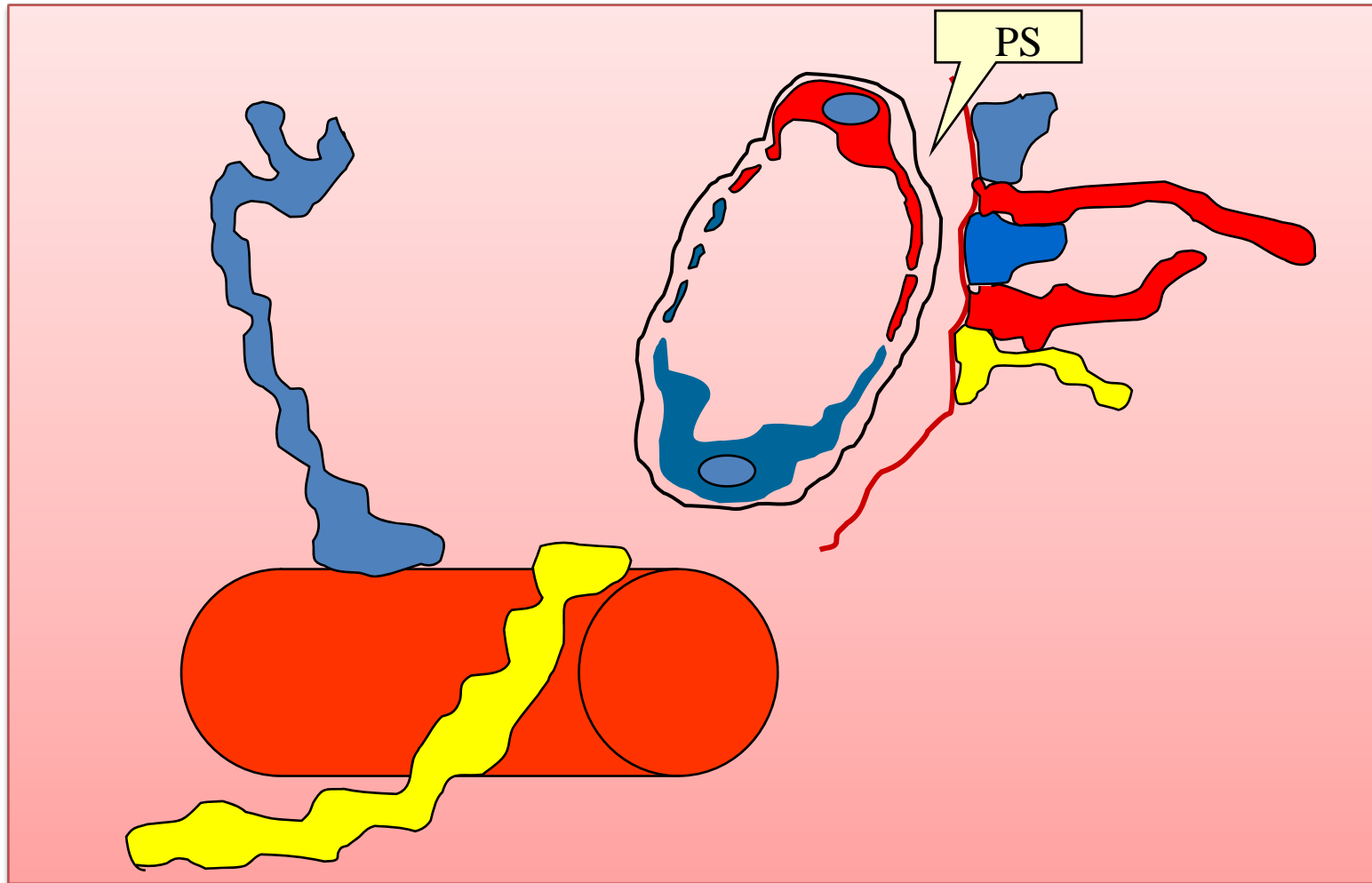


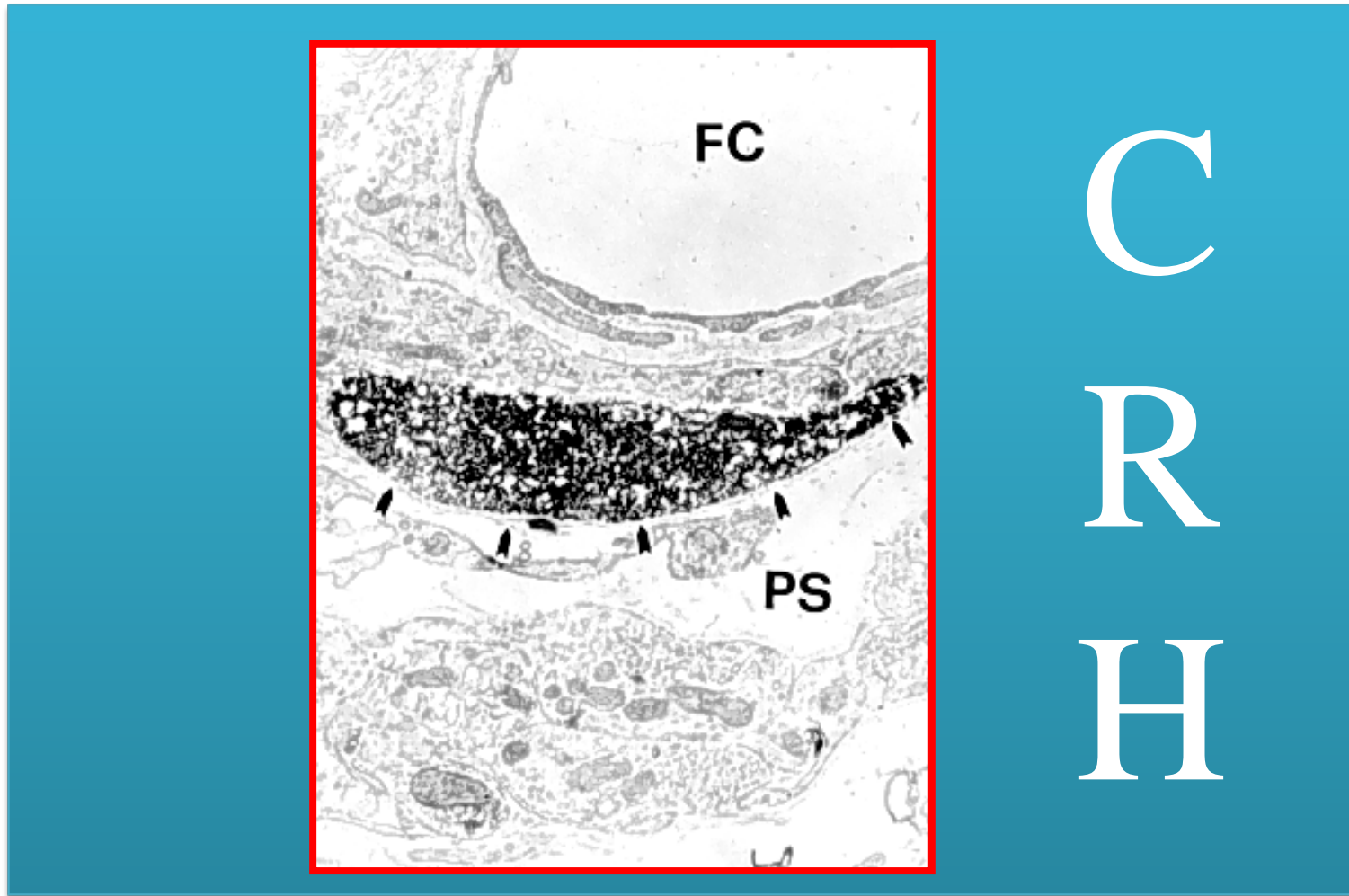






Median eminence



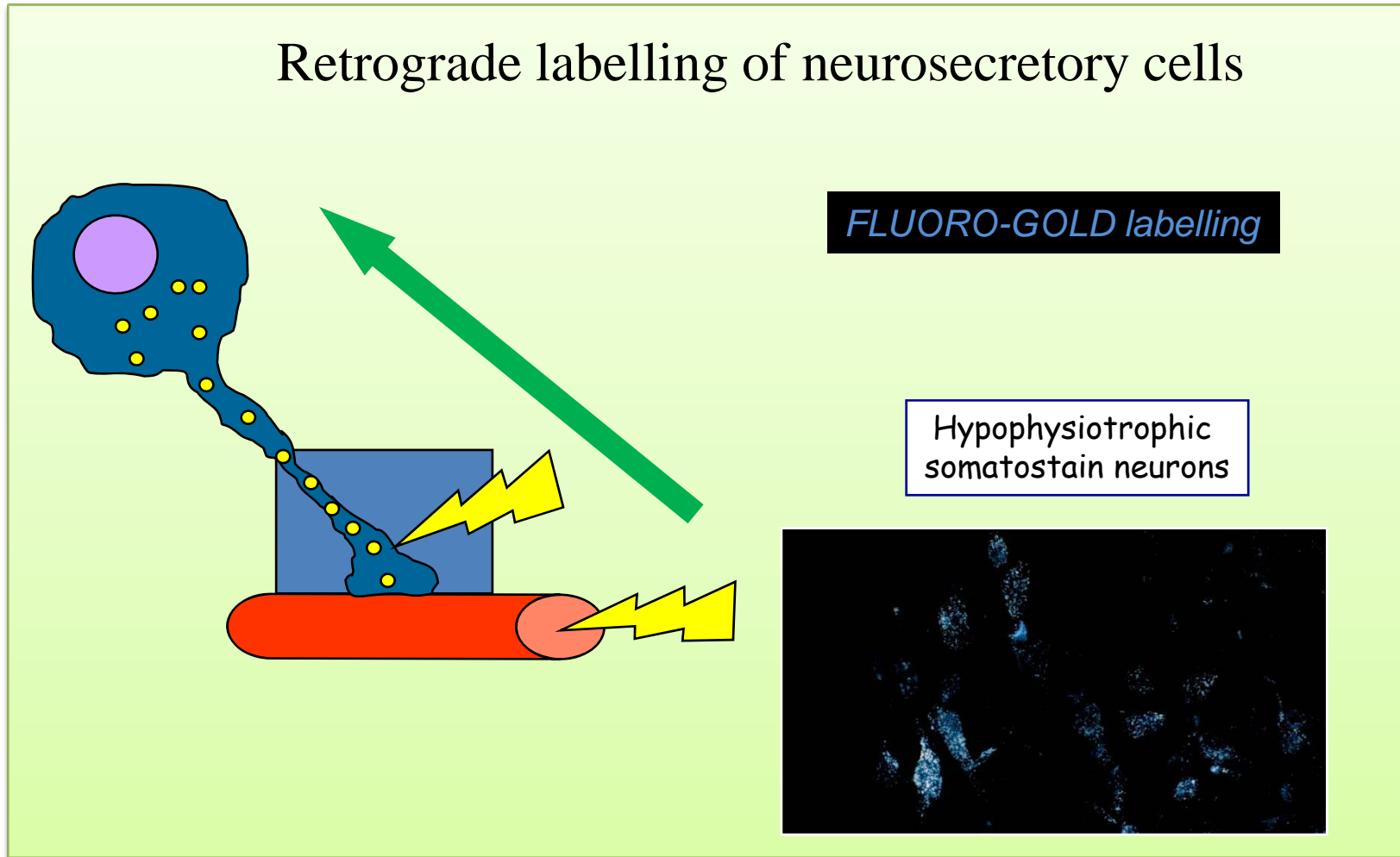


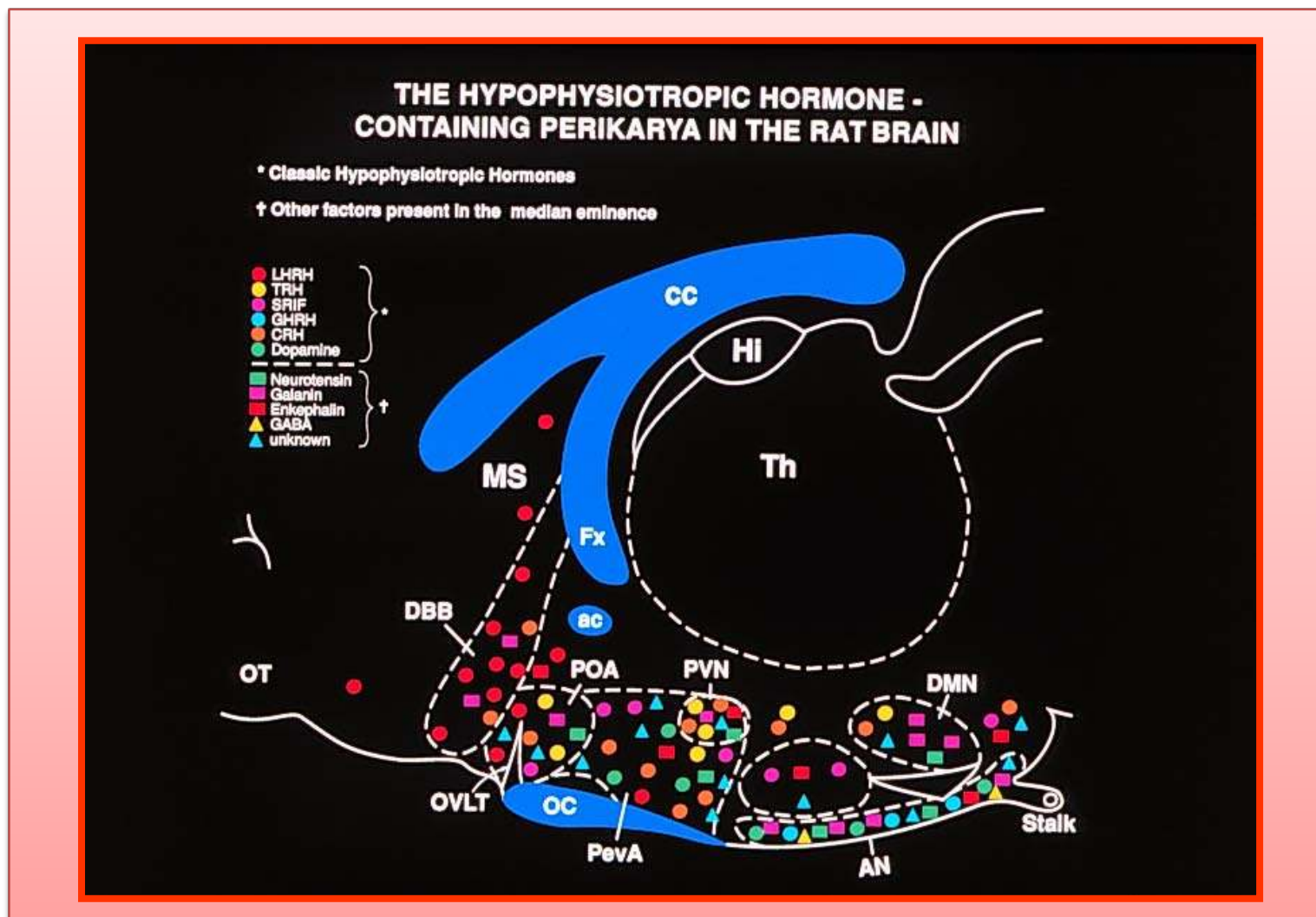
Hypothalamic neurosecretory hormones

1. Synthesized in *neurons*
2. Transported via *axo-plasmic flow*
3. Stored and released from *axon terminals*
4. **Secreted into the *blood stream***
5. **Have *specific receptors***
6. Influence target structures via *receptor-coupled mechanisms*
7. *Biologically active*



Retrograde labelling of neurosecretory cells

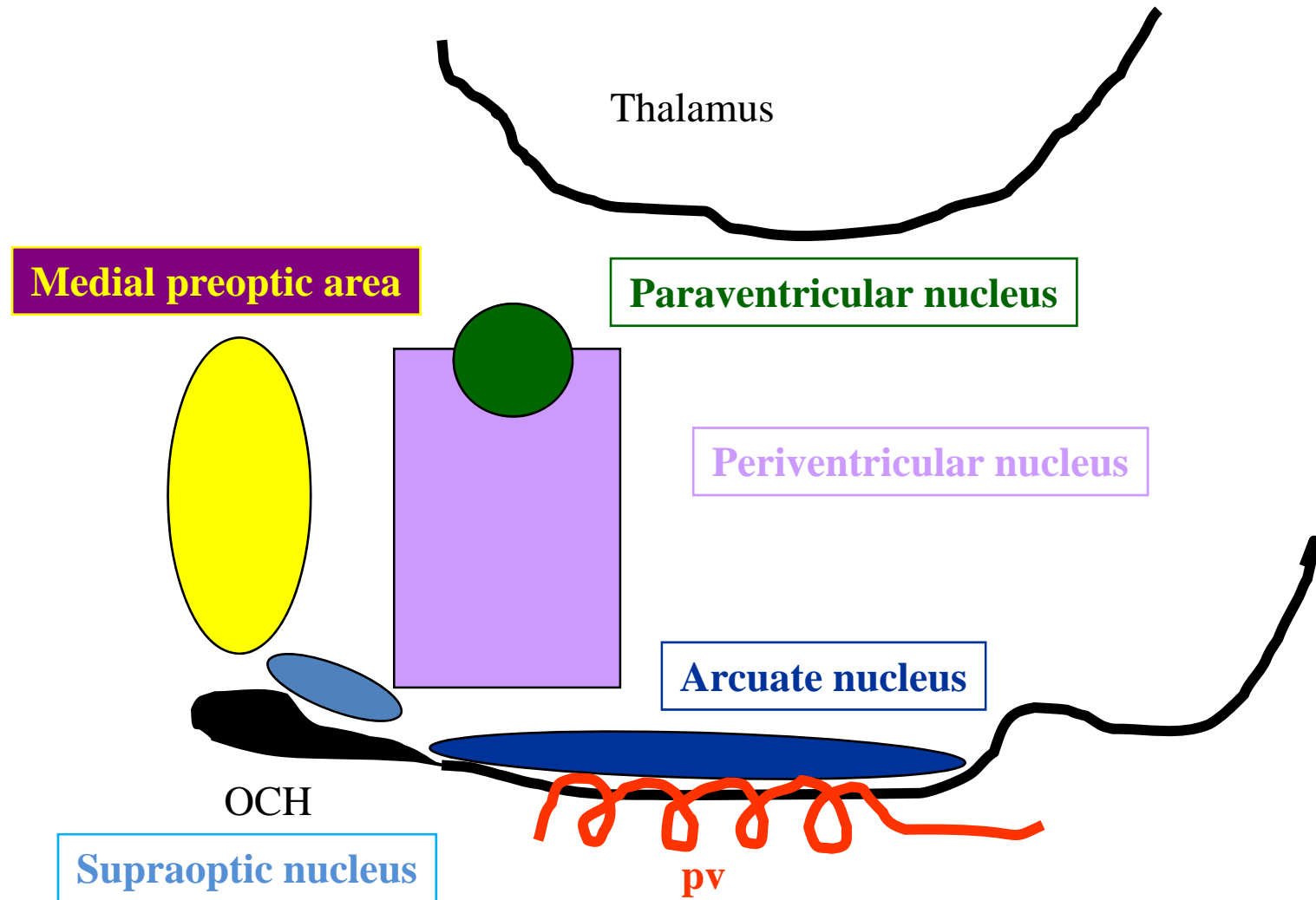


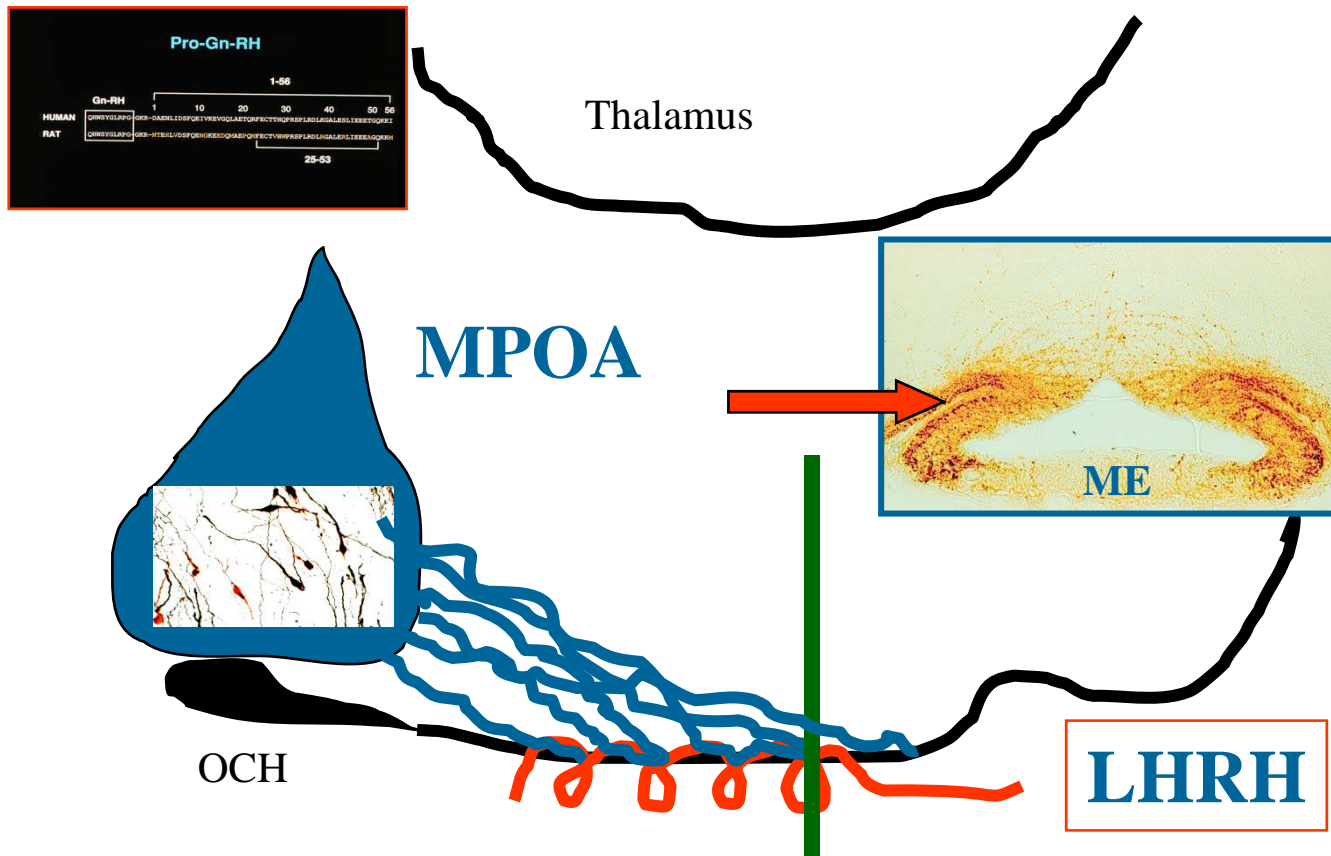


Luteinizing hormone-releasing hormone (LHRH)
Thyrotropin-releasing hormone (TRH)
Somatostatin
Corticotropin-releasing hormone (CRH)
Growth hormone-releasing hormone (GHRH)
Dopamine

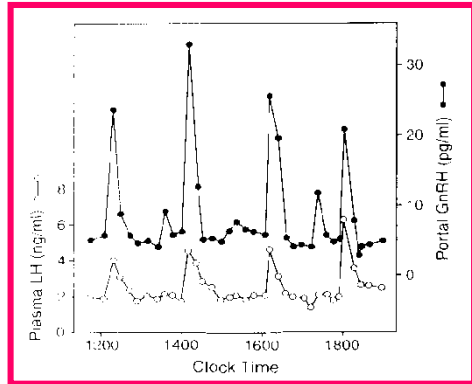
Oxytocin
Vasopressin
Neurophysin I-II

Galanin
CART

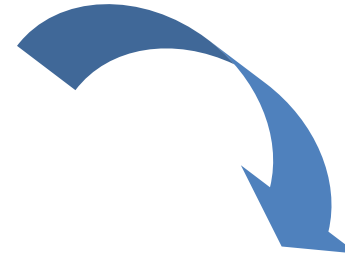
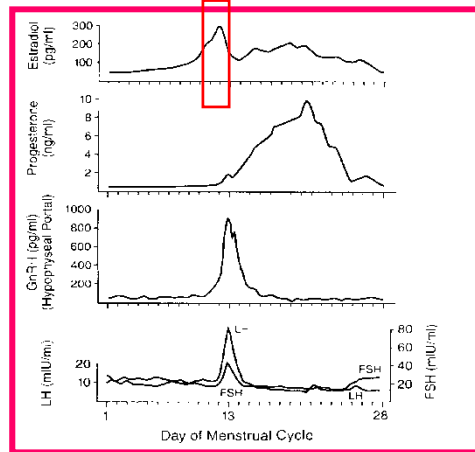




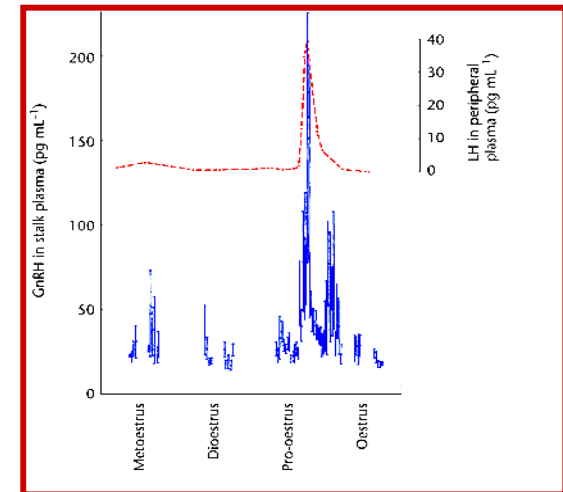
Pulsatile secretion of GnRH and LH

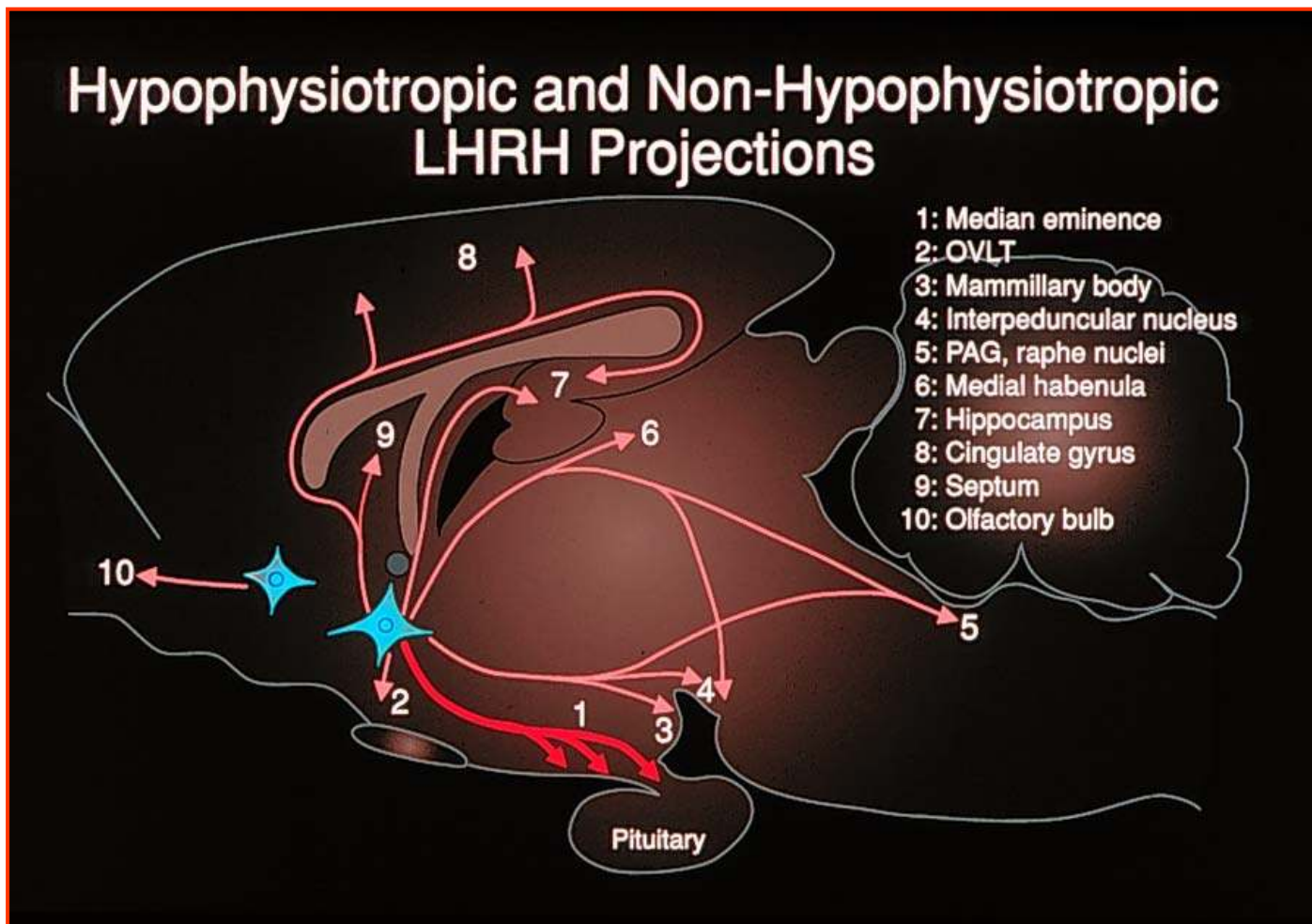


Positive estrogen trigger

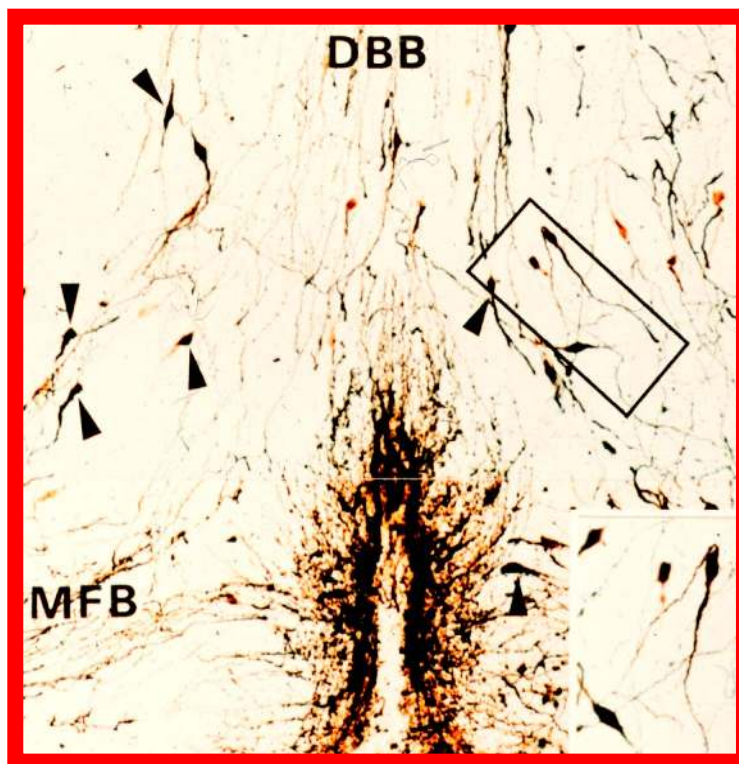


GnRH and LH peaks induced by estrogen



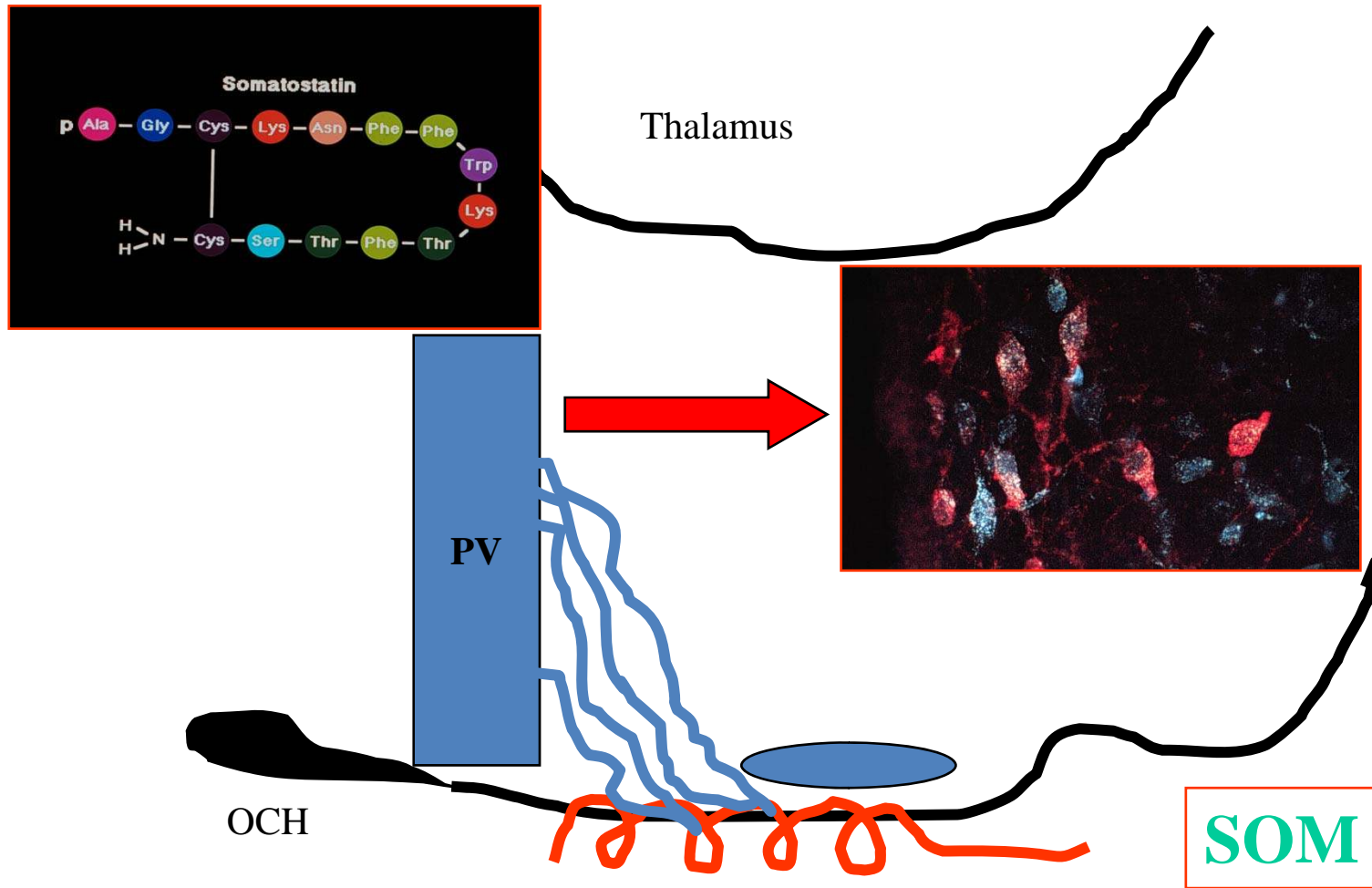


LHRH neurons in the OVL region of the rat



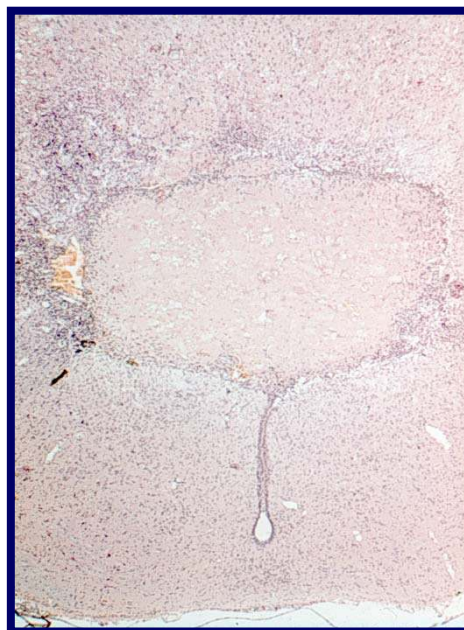
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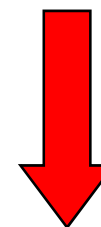


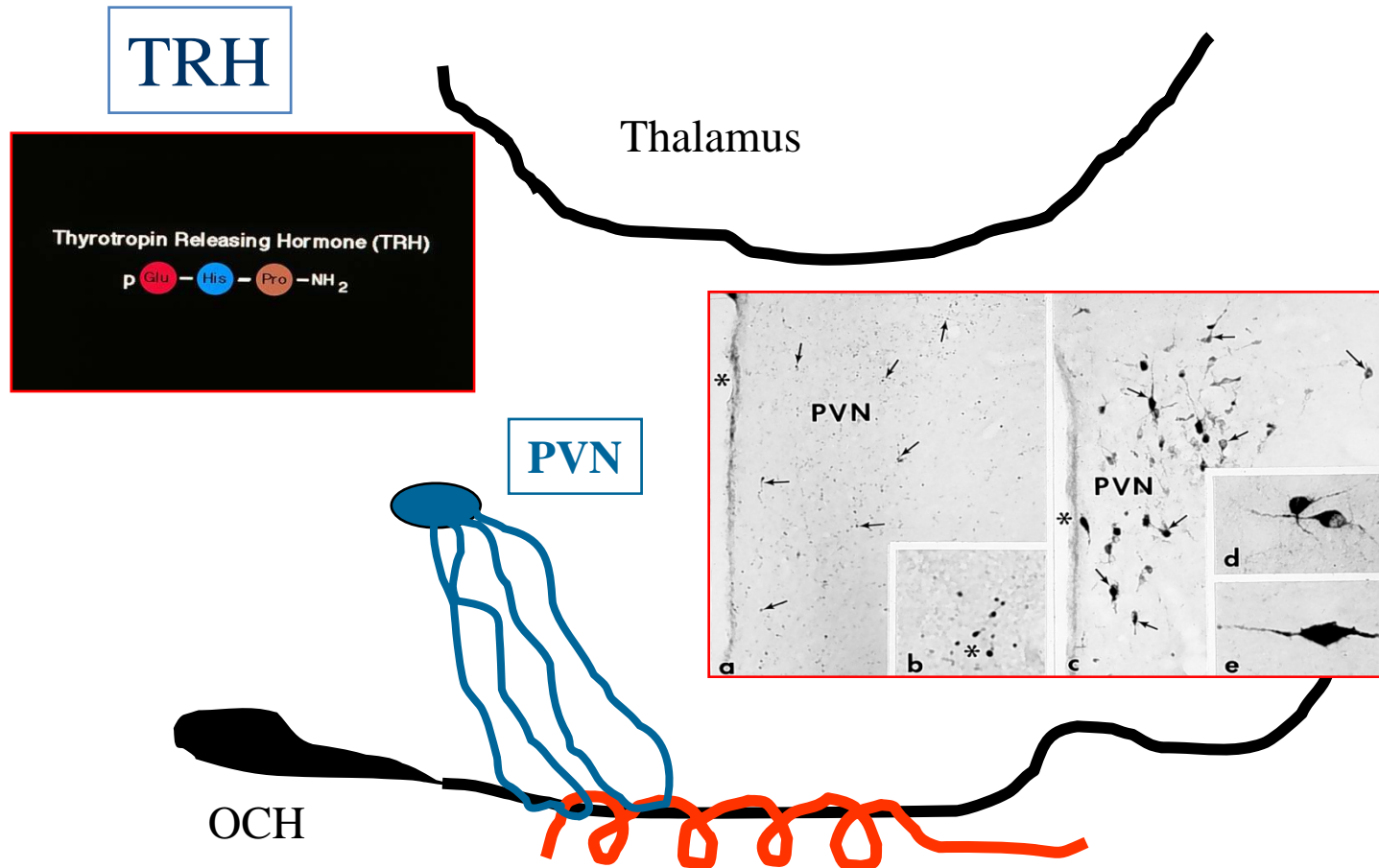


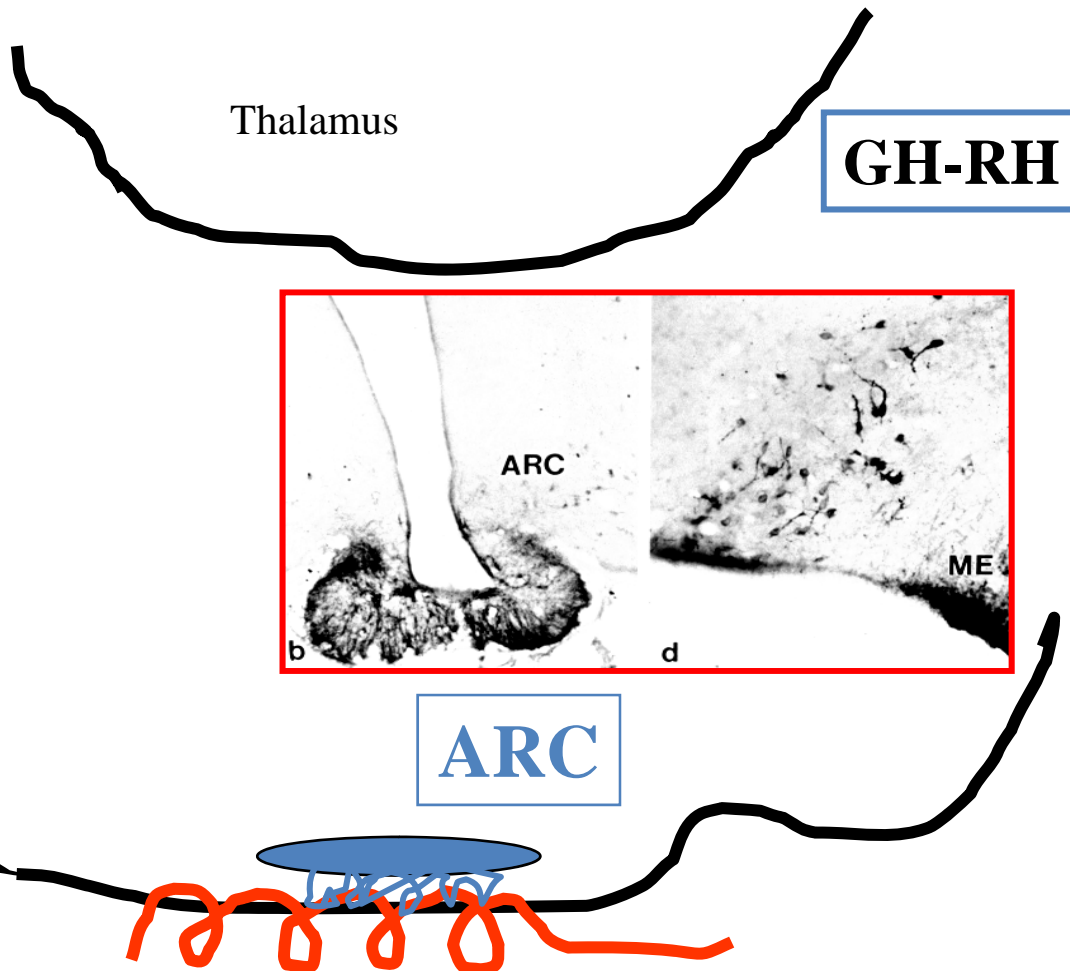
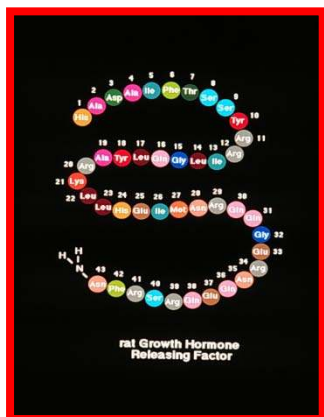
CRH



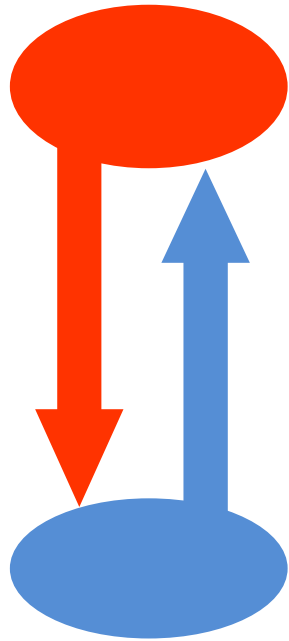
PVN-X



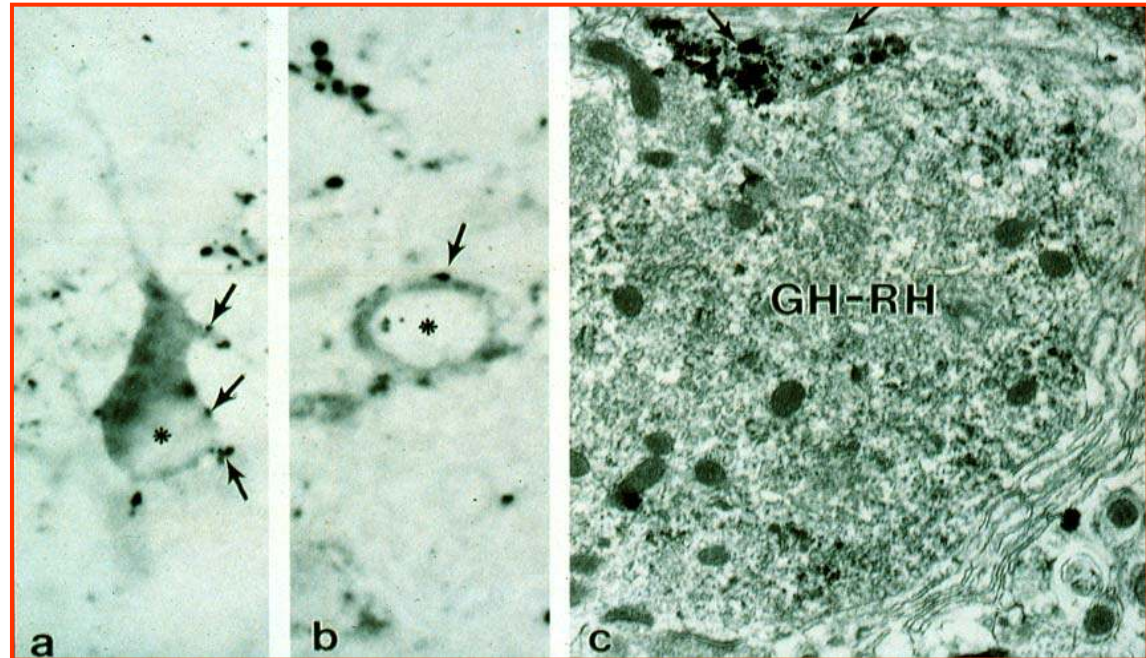


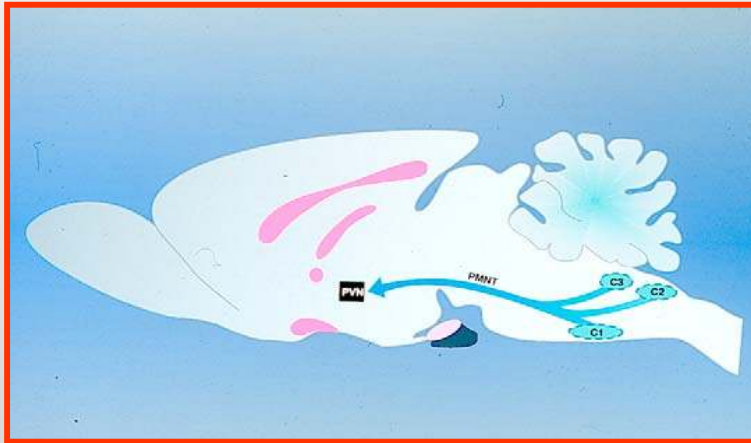


SOM



GHRH

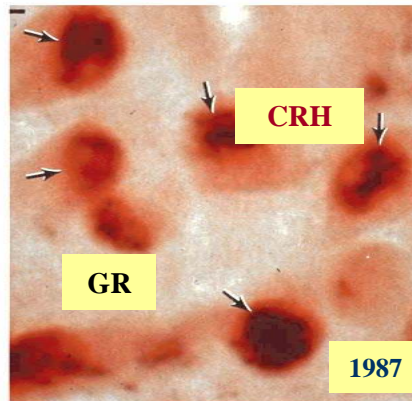
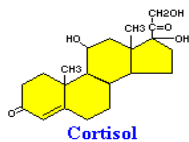
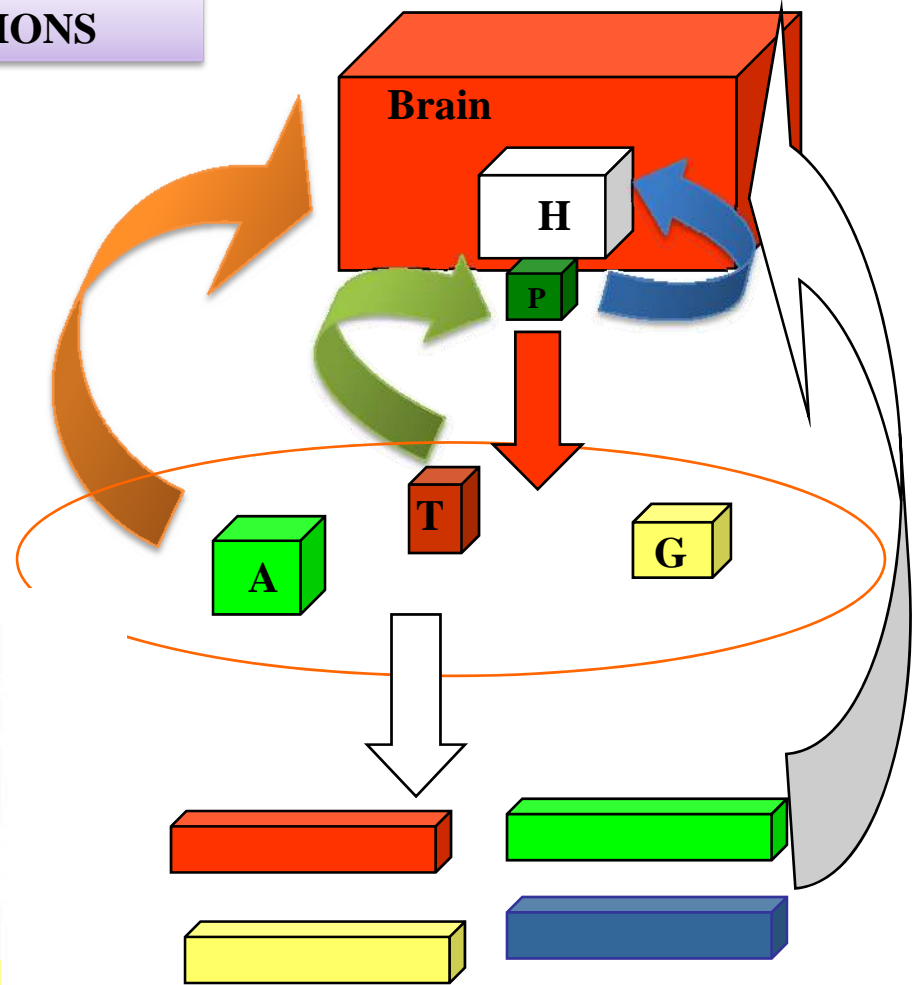
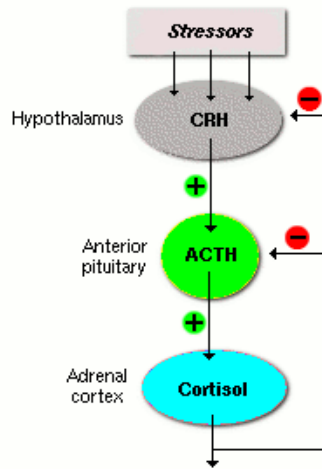




PNMT-CRH



HORMONAL FEEDBACK ACTIONS



„Discovery is seeing what everyone has seen and thinking what no one else has thought”

A. Szent-Györgyi