

# The Hypothalamo-Pituitary-Gonadal Axis

**François Pralong**

**Services d'Endocrinologie, Diabétologie et Métabolisme, Hôpitaux  
Universitaires de Genève et Lausanne**

**Centre des Maladies CardioVasculaires et Métaboliques, Lausanne**



# The hypothalamus

## Specific functions

- 1) Control of anterior pituitary, via **neuro-hormones** (releasing factors)

# **The hypothalamo-hypophyseal hormonal axes**

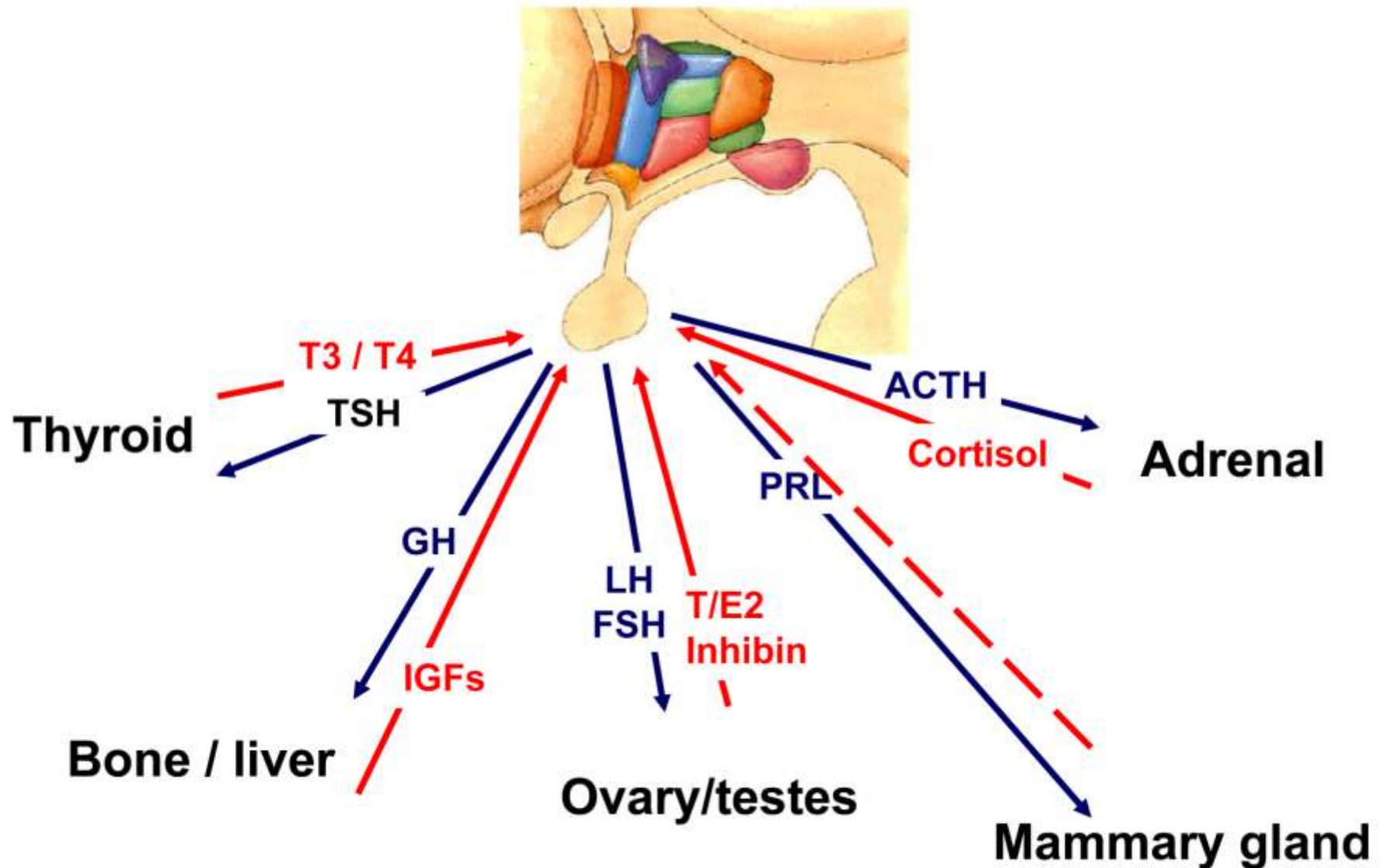
Functional units:

**HT - HP – peripheral glands**

Interdependent secretions

Feed-forward and feed-back effects

# The 5 classical neuroendocrine axis



# Hormones are messengers

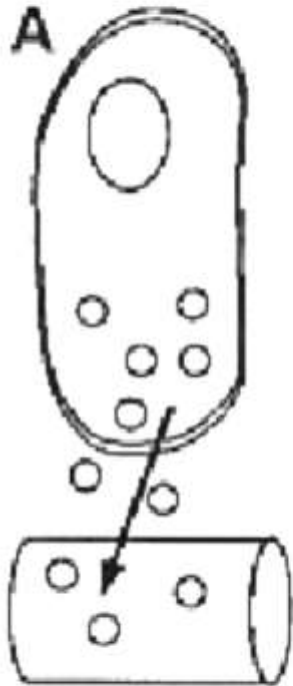
## Hormone:

Chemical signal secreted into the circulation and modulating the function of distant organs.

Particular exemple of a more generalized biological process

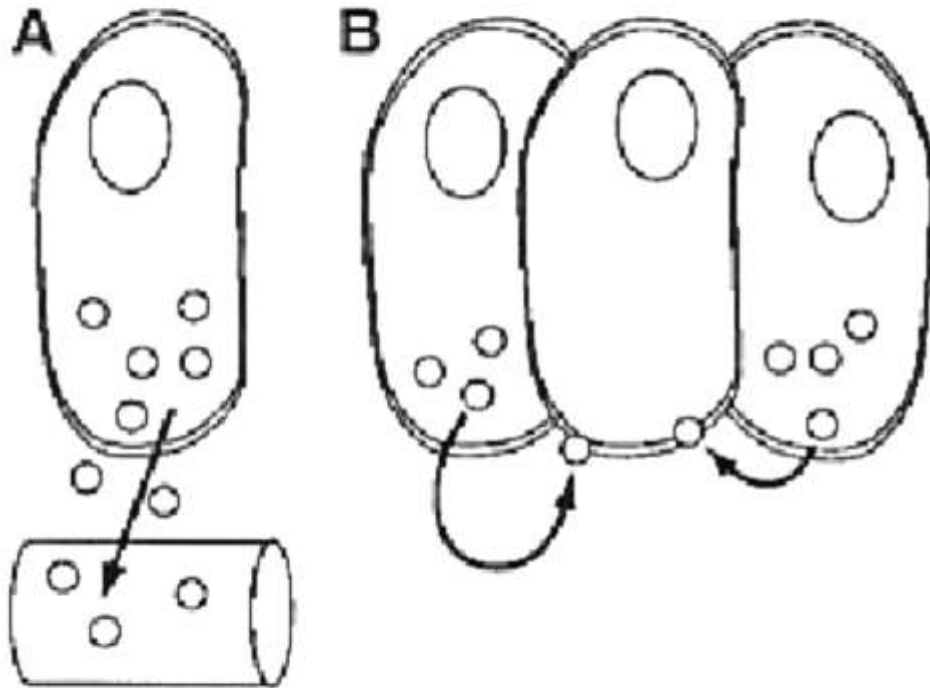
## Inter-cellular signalling

# Different types of hormonal interactions



**Endocrine**

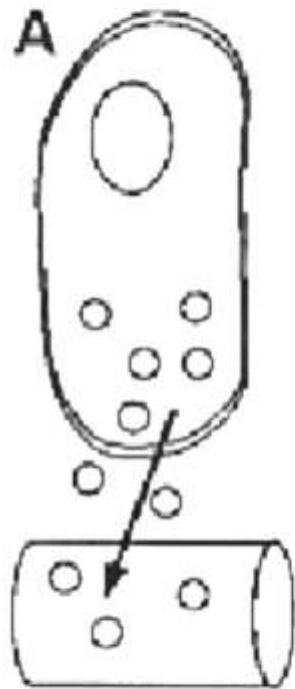
# Different types of hormonal interactions



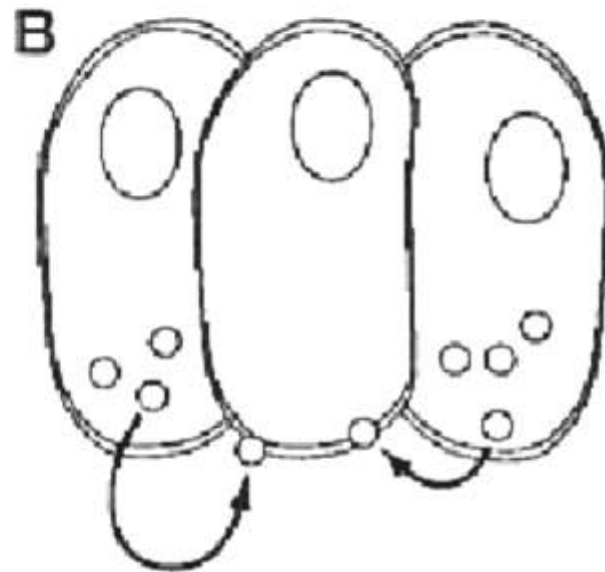
**Endocrine**

**Paracrine**

# Different types of hormonal interactions



**Endocrine**

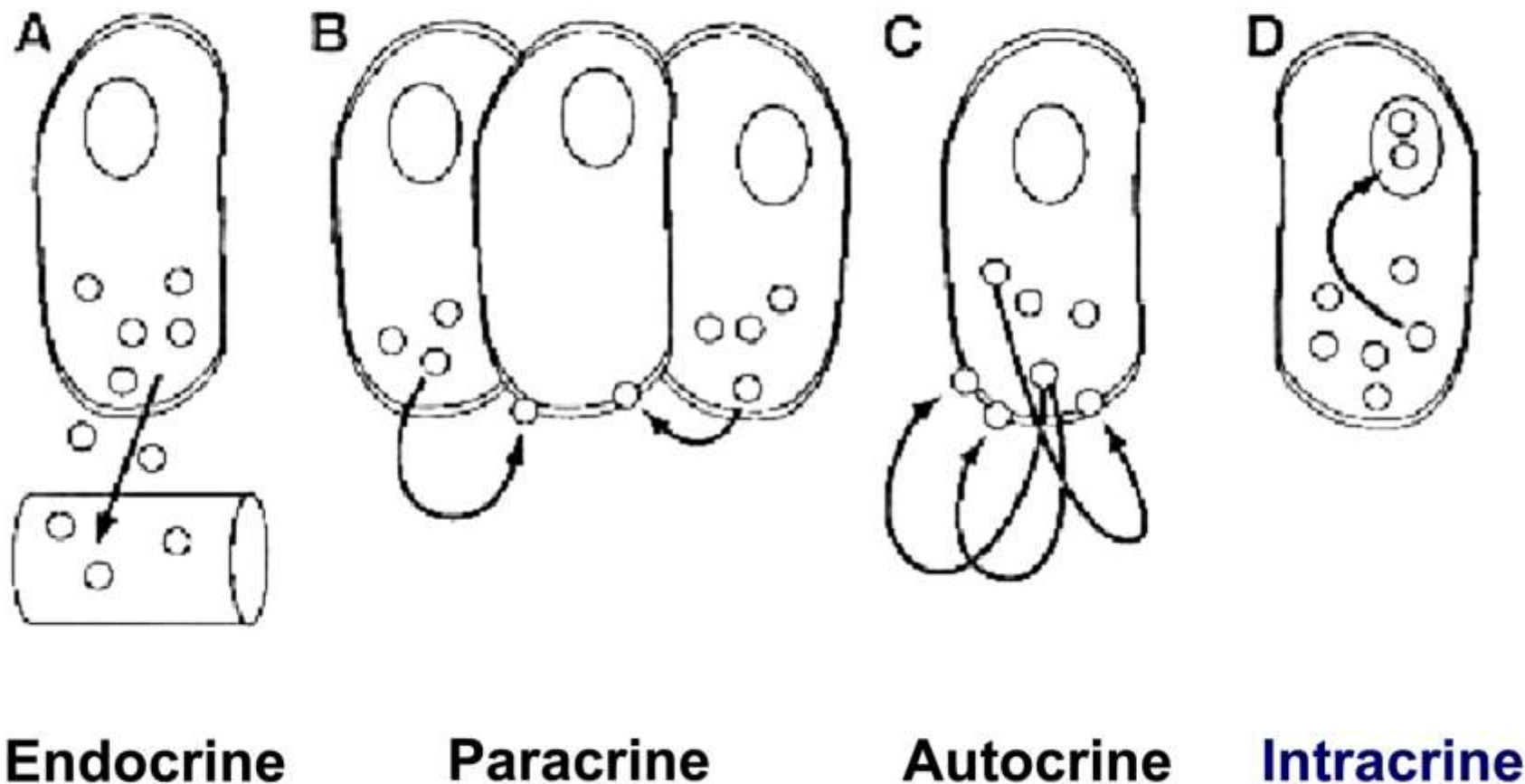


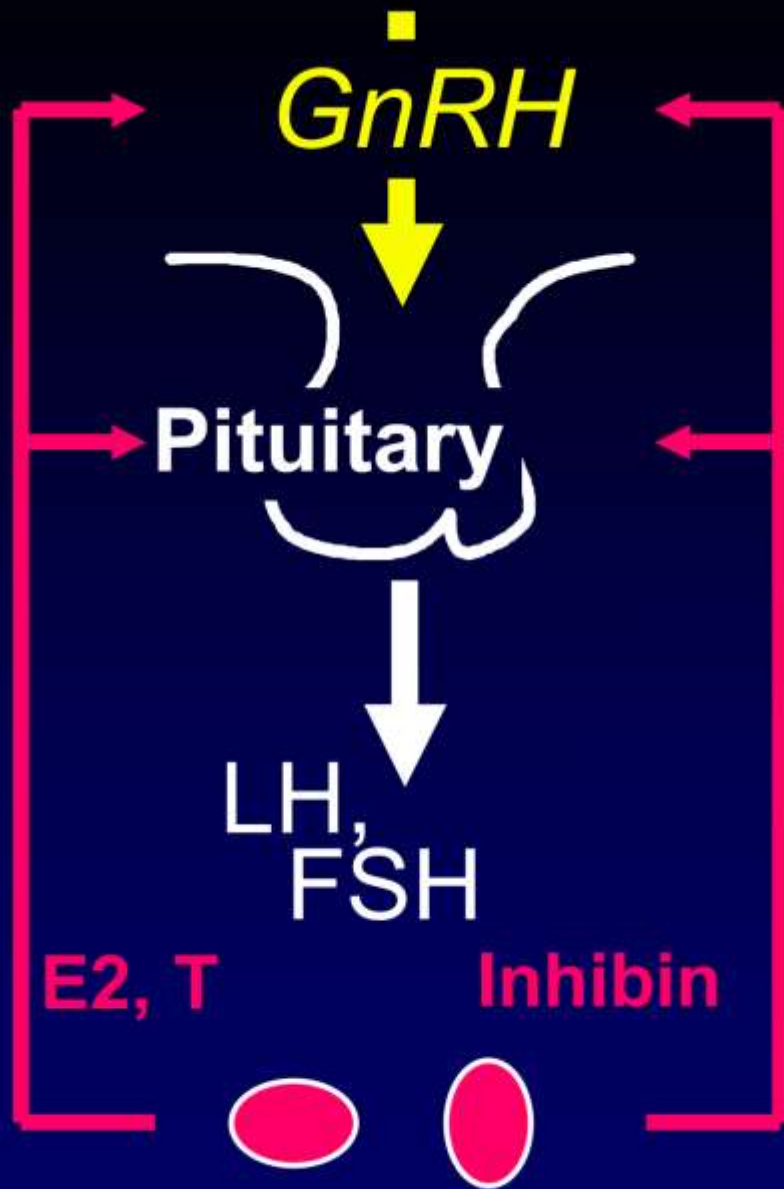
**Paracrine**



**Autocrine**

# Different types of hormonal interactions





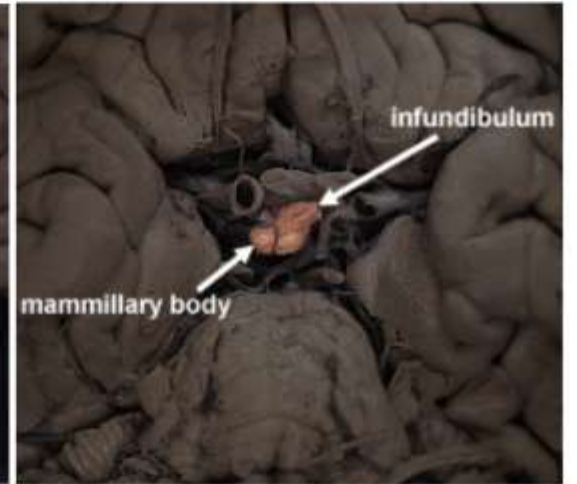
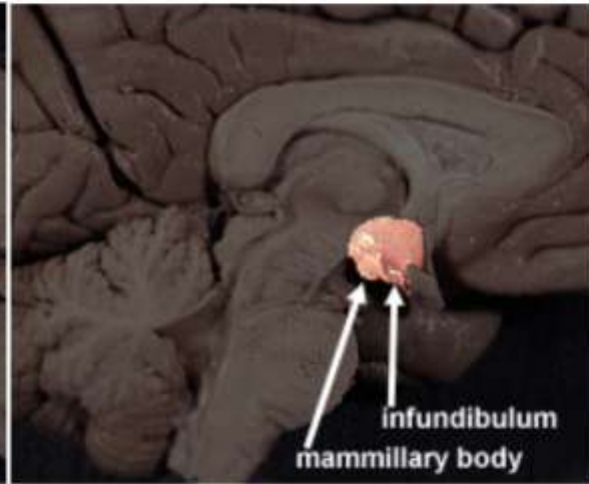
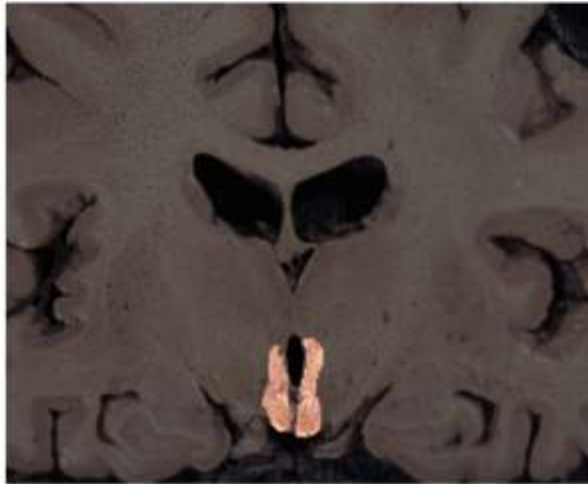
**GnRH**

*Gonadotropin Releasing  
Hormone*

**Luteinizing Hormone**

**Follicle Stimulating  
Hormone**

# **Functional anatomy of hypothalamo-pituitary unit**



# The Hypothalamus

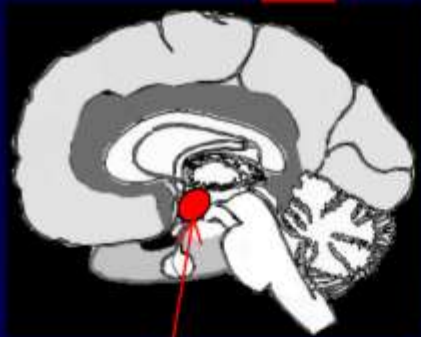
## Structure

**Different groups of neurones (nuclei) located in the walls of the inferior part of the third ventricle**

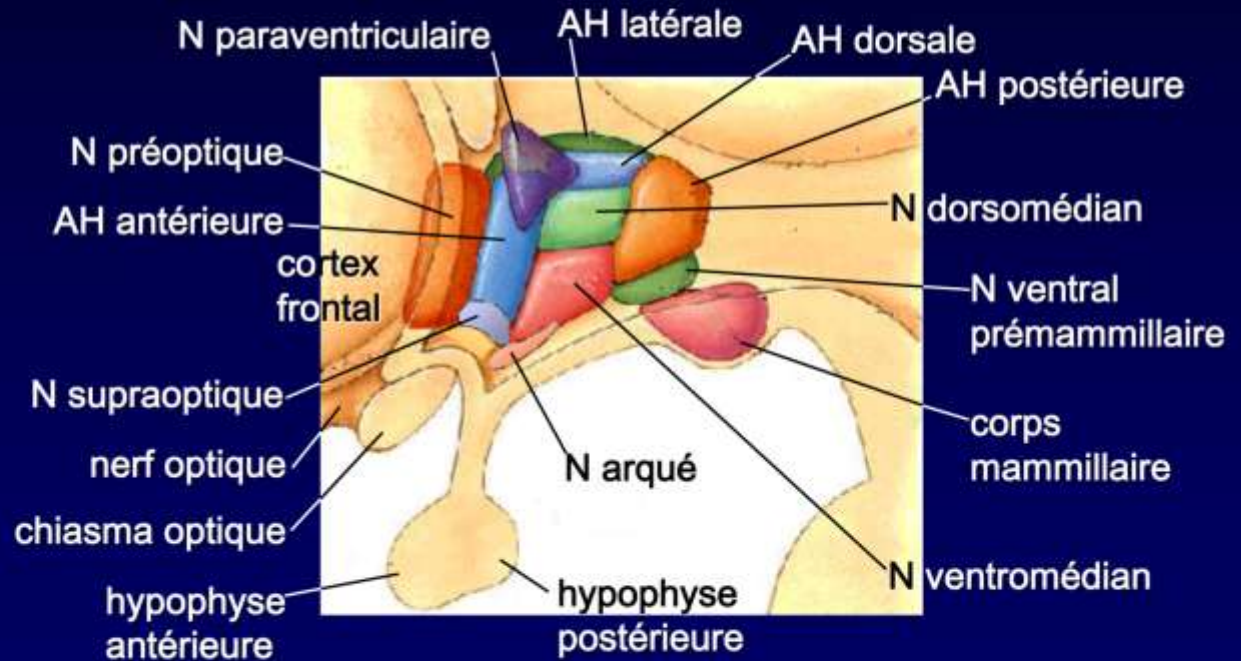
## Fonction

**Crossroad where numerous humoral signals are meeting and integrated, resulting in **metabolic and neuroendocrine** regulations.**

# The Hypothalamus



hypothalamus



# The Hypothalamus

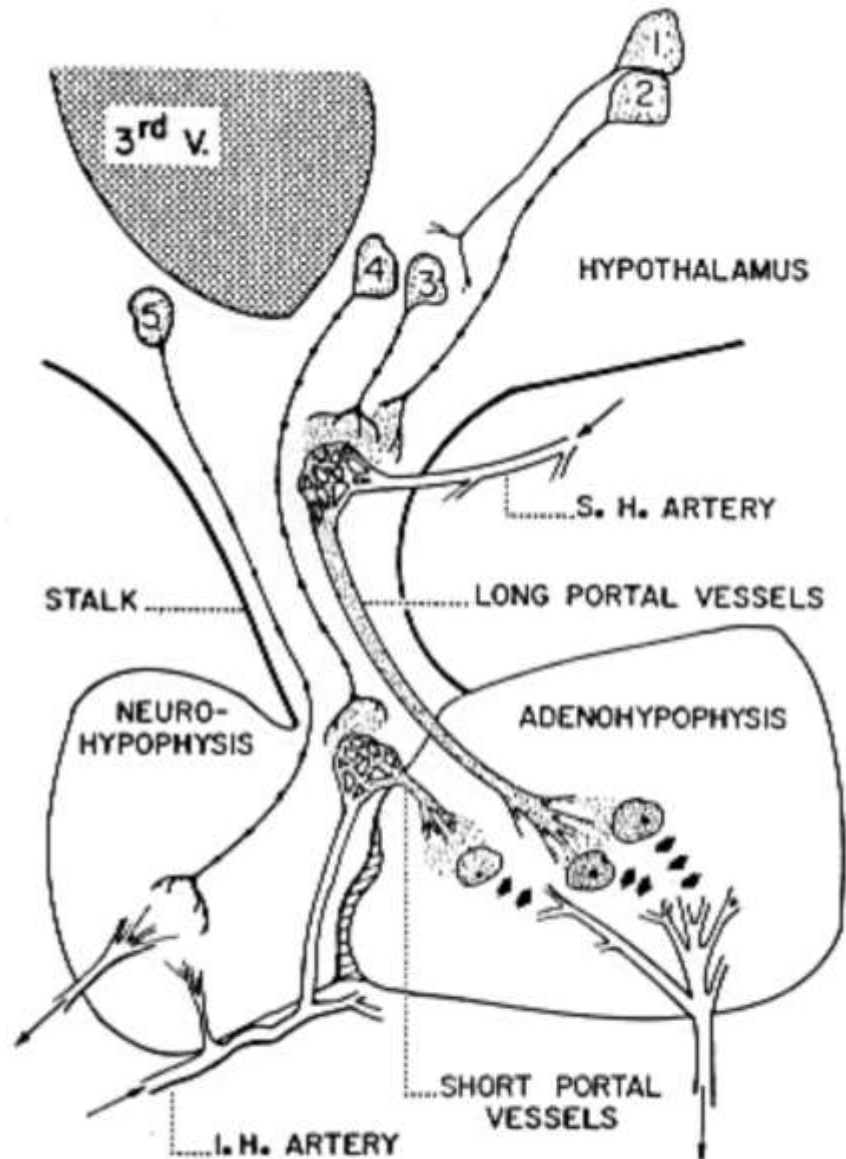
## Specific functions

- 1) Control of anterior pituitary, via *neurohormones* (releasing factors)
- 2) **Synthesis of hormones to be stocked in posterior pituitary (then secreted into the peripheral circulation)**
- 3) **Modulation of food intake, metabolism and energy expenditure**

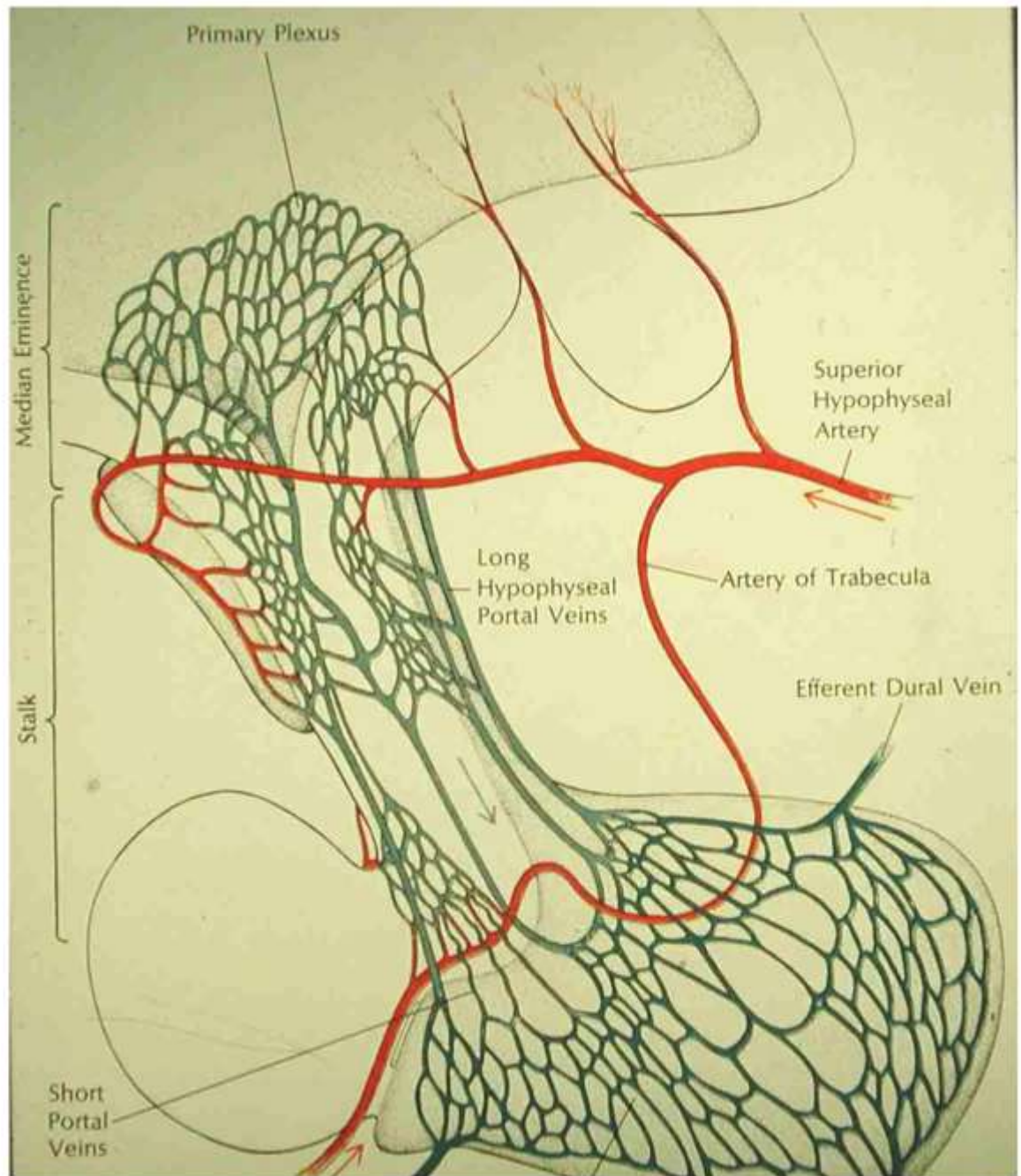
# ***HORMONAL TRANSMISSION HT- HP***

***Anterior pituitary:  
vascular***

***Posterior pituitary :  
neuronal***



# The hypothalamo- hypophyseal portal blood vessels system



## **Anterior pituitary (adeno-hypophysis):**

No nervous connection

## **Posterior hypophysis (neuro-hypophysis):**

Connected to the hypothalamus (nervous connections)

IRM

V<sub>III</sub>  
CO  
LA  
SS  
LP

500  
15  
4:19  
2

Thk  
Pos  
Seg

**NMR**

**CO**

**Tige**

**V<sub>III</sub>**

**LA**

**SS**

SE1  
TR 500  
TE 15  
TA 6:27  
NO 3  
FOV 210.0 s  
M 256x512 o

Thk 2.0  
P 9.2  
Cor

h= A2

MAGNETOM 1.5 T

# NMR, contrast

Limit of BBB

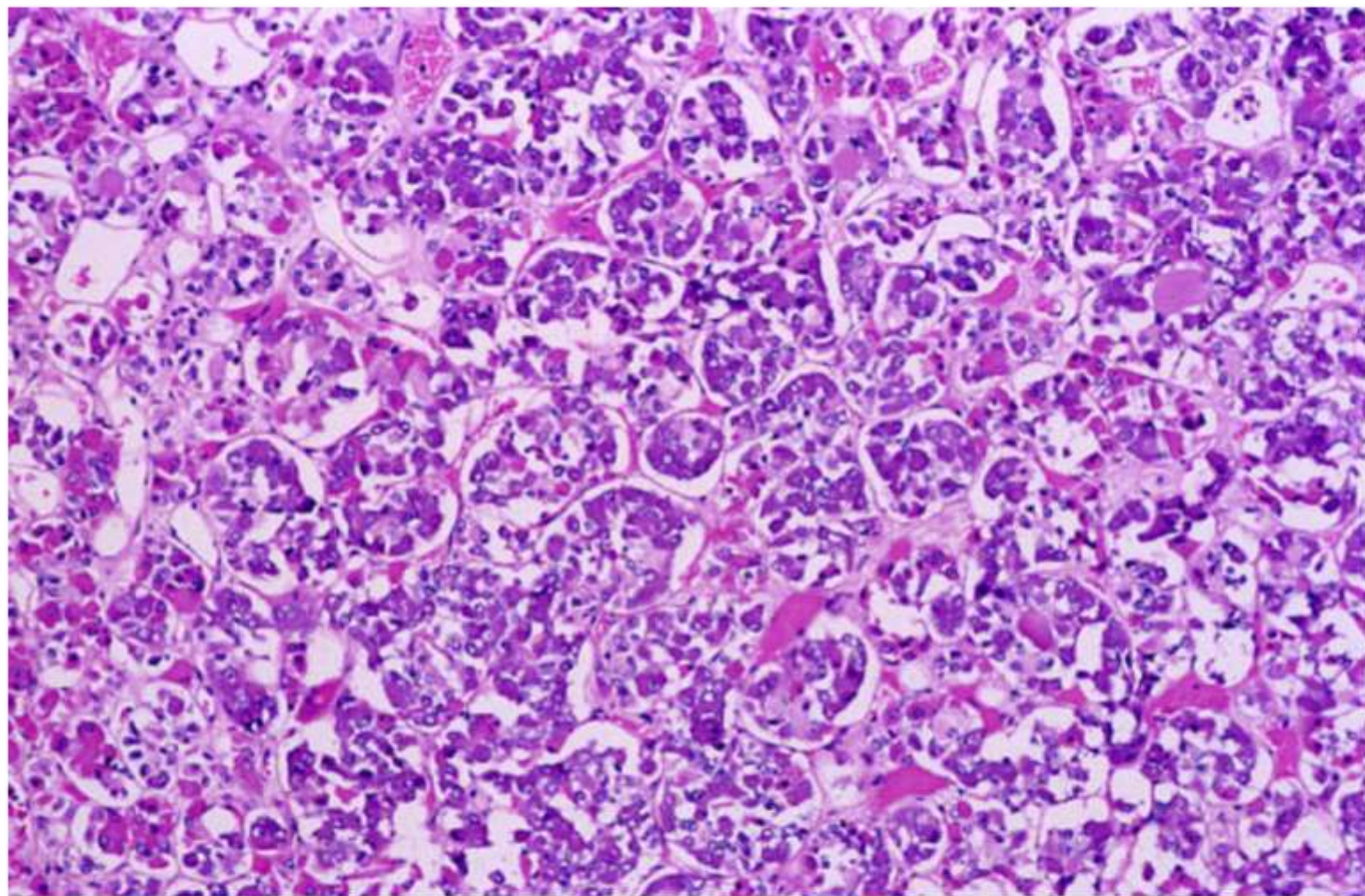


SE1  
IR 501  
TE 15  
TA 8:36  
ACQ 4  
FOV 210.0  
M 256x512

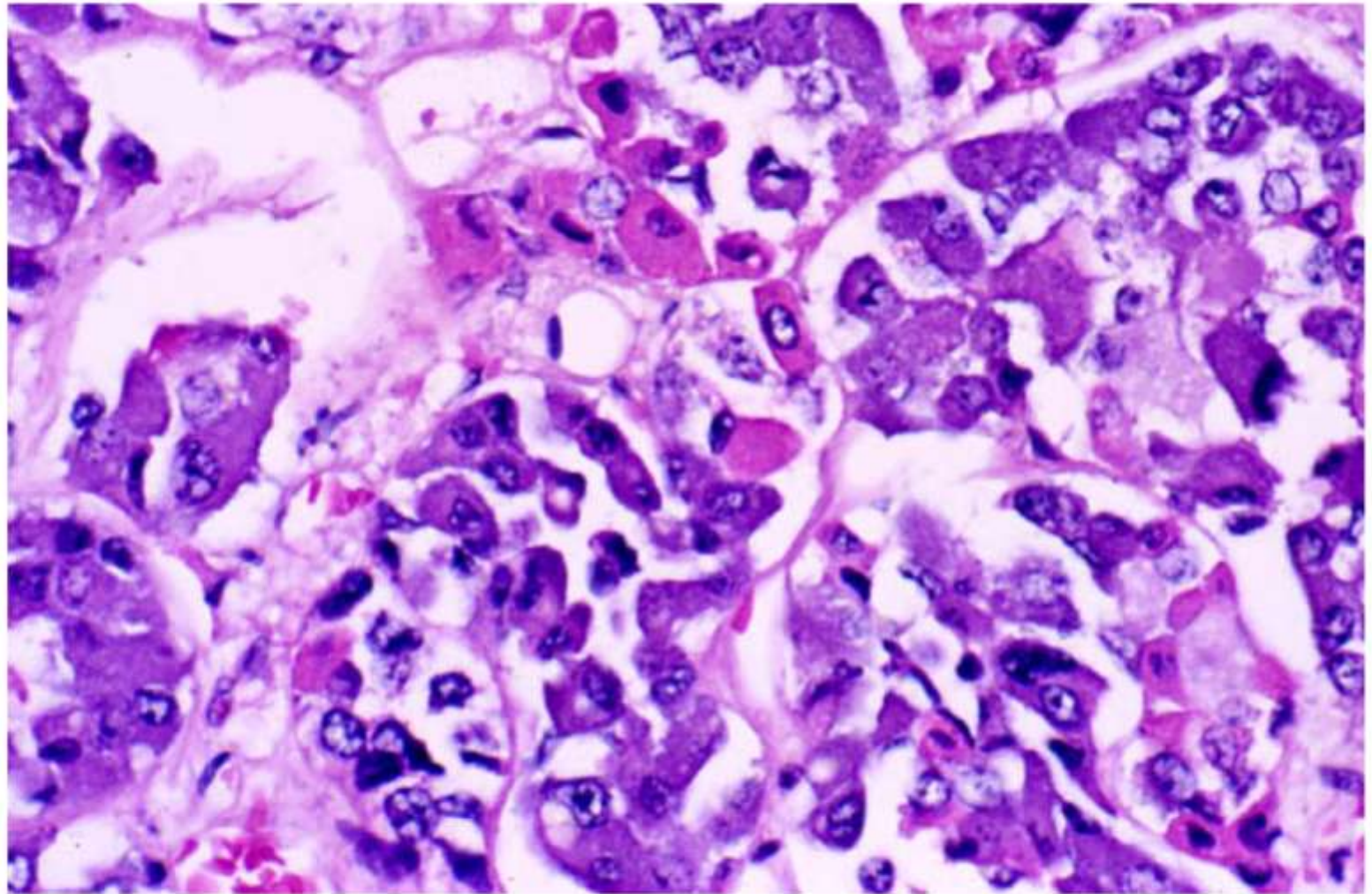
Thk 2.0  
Pos 9.2  
Cor

h's A2

MAGNETOM 1.5 T



Anterior pituitary, H&E, x66



Anterior pituitary, basophils, acidophils, and chromophobes, H&E, x132

### **Acidophil cells:**

GH, PRL

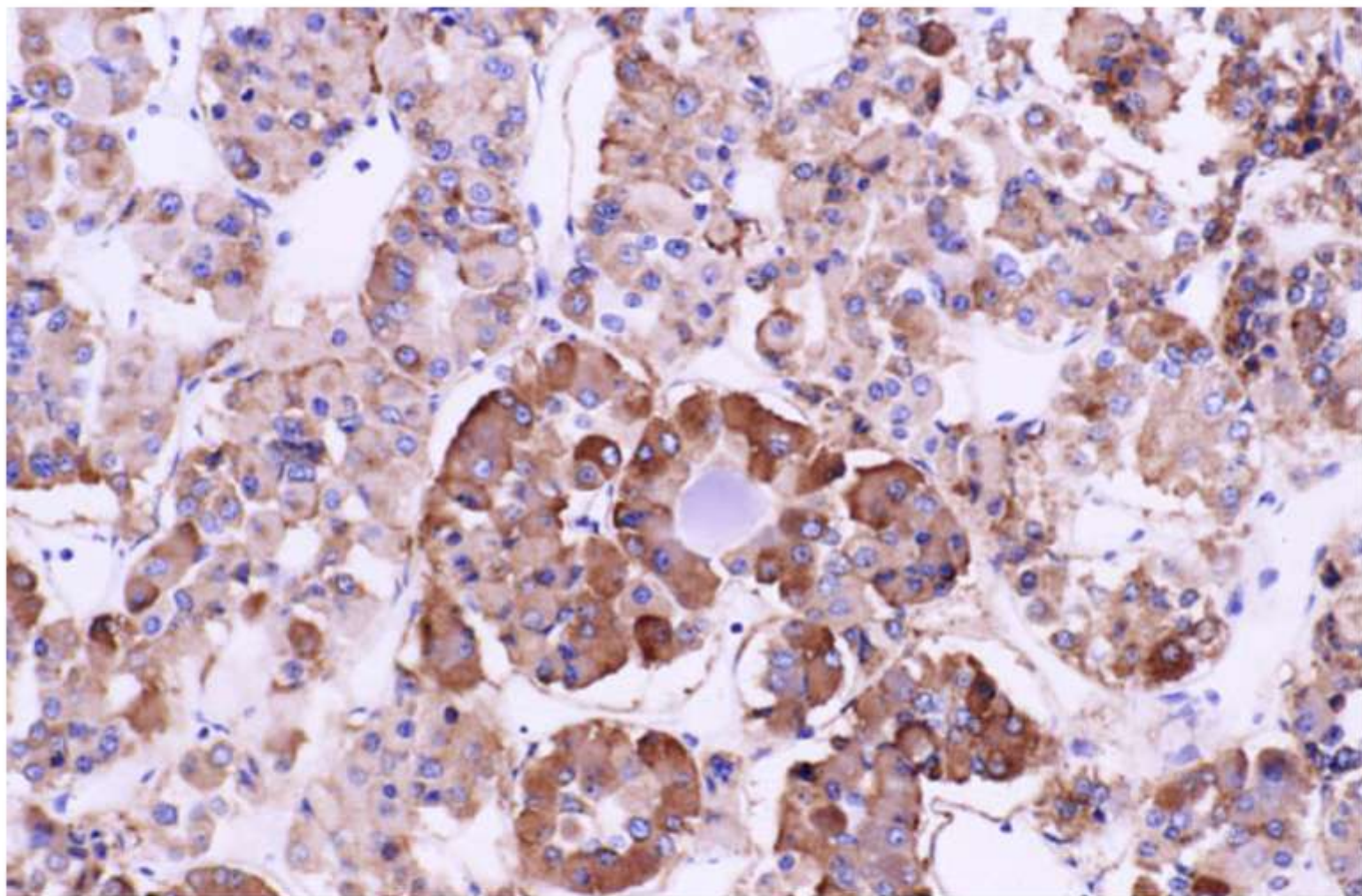
### **Basophil cells:**

TSH, LH et FSH, ACTH

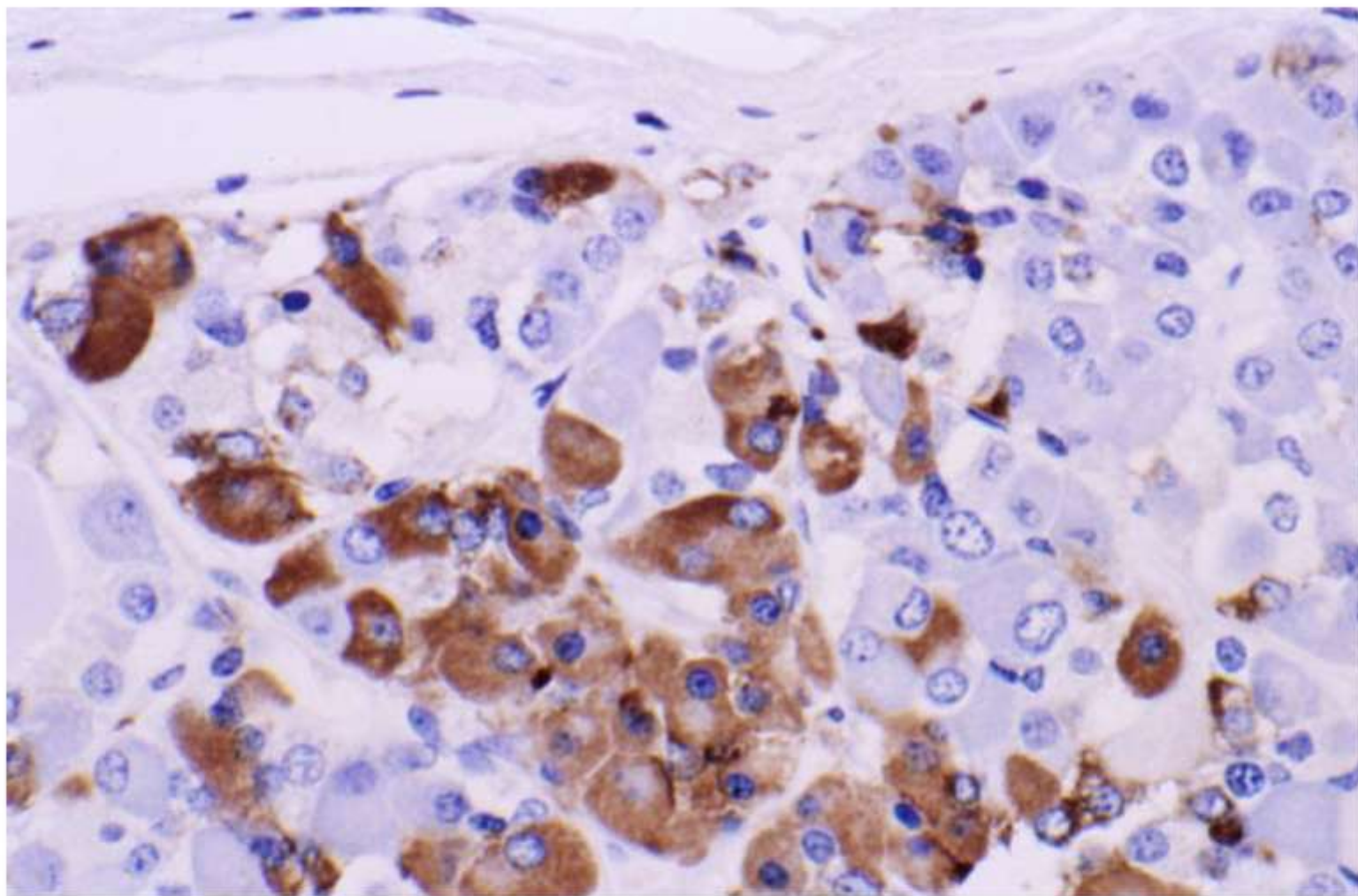
### **Chromophobe cells:**

No hormonal content. Stem cells? Structure cells?

Folliculo-stellate cells: involved in keeping the pituitary structure



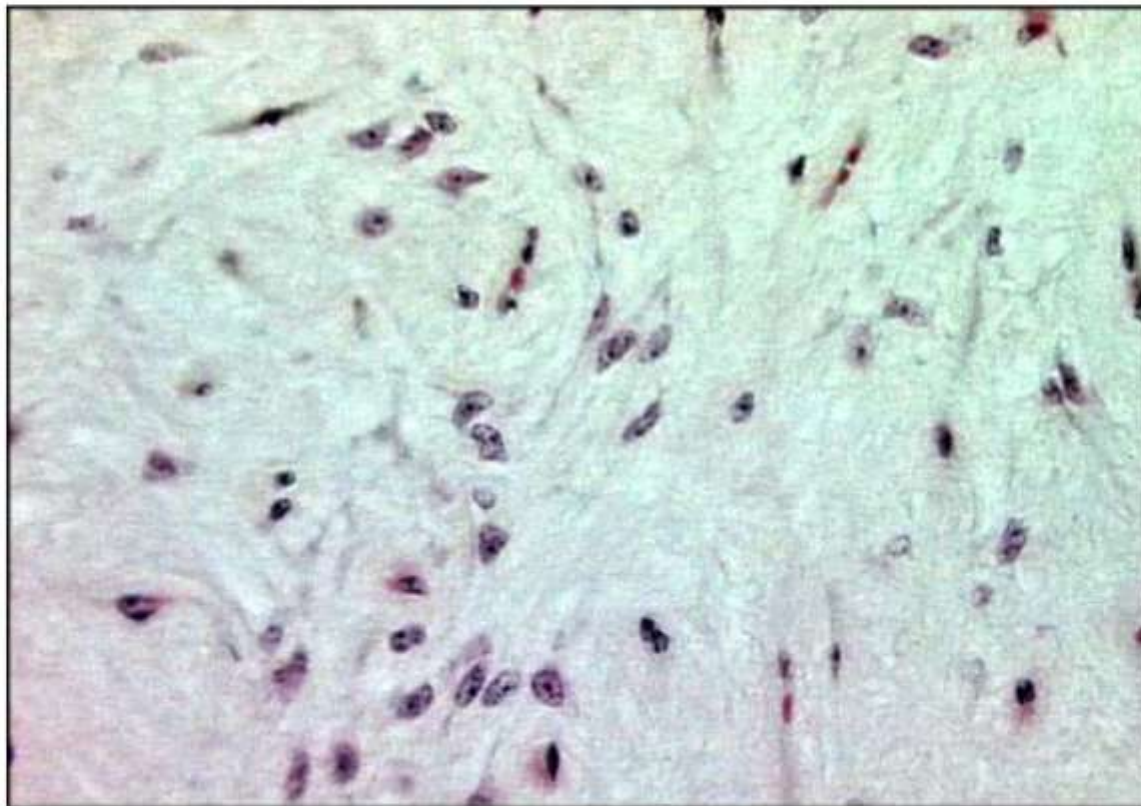
Anterior pituitary: immunohistochemistry [synaptophysine](#)  
(immunoperoxidase, x66)



Anterior pituitary: immunohistochemistry prolactin  
(immunoperoxidase, x132)

The **posterior pituitary** contains essentially neurosecretory neurons non myelinated, originating from the hypothalamic supra-optic and paraventricular nuclei

They secrete **oxytocin and vasopressin**.



Axonal prolongations, mixed with glial cells and capillaries



989762  
15-DEC-1954  
14:01  
30-MAR-2001  
IMAGE 48  
SER 1-5

MF 2.00

RP

H

MAGNETOM Symphony  
H-SP VA13E  
+ : F A L



SD 47 0

09:13  
22-FEB-2002  
IMAGE 26  
SER 1-3

NF 2.00

RA



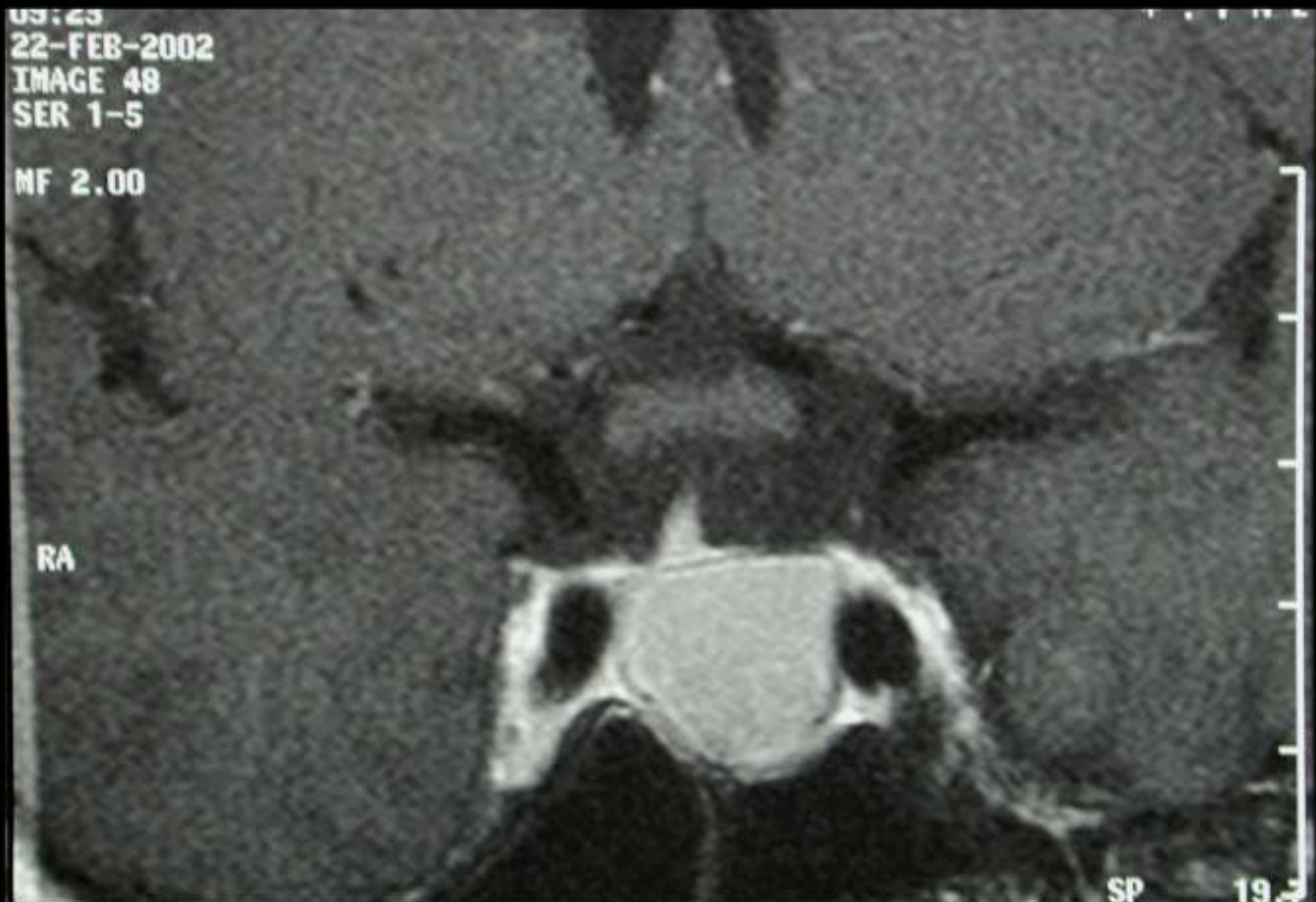
09:23  
22-FEB-2002  
IMAGE 48  
SER 1-5

MF 2.00

RA

SP

19.5



09:07  
22-FEB-2002  
IMAGE 12  
SER 1-2

MF 1.15

AL

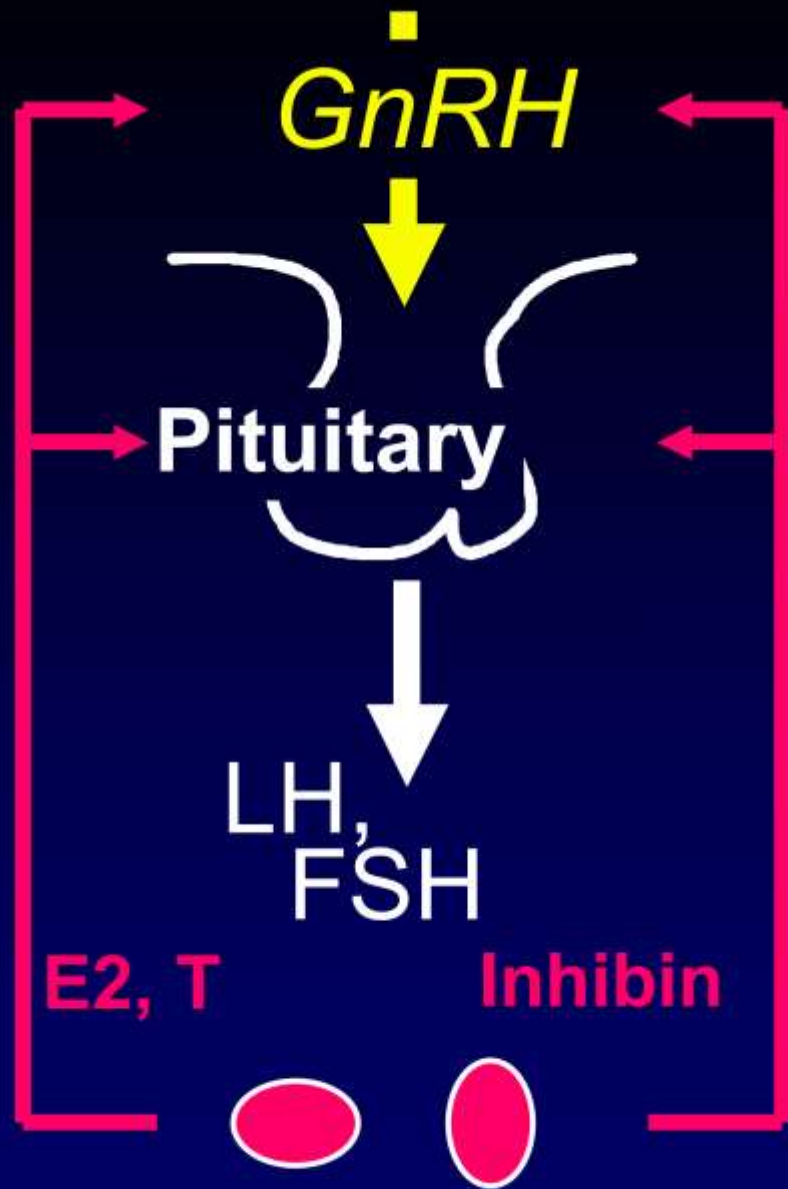
se1

65

SP -0.9  
SL 3.0  
FoV 230\*230



# **The neuroendocrine reproductive axis and hypothalamic GnRH neurons**



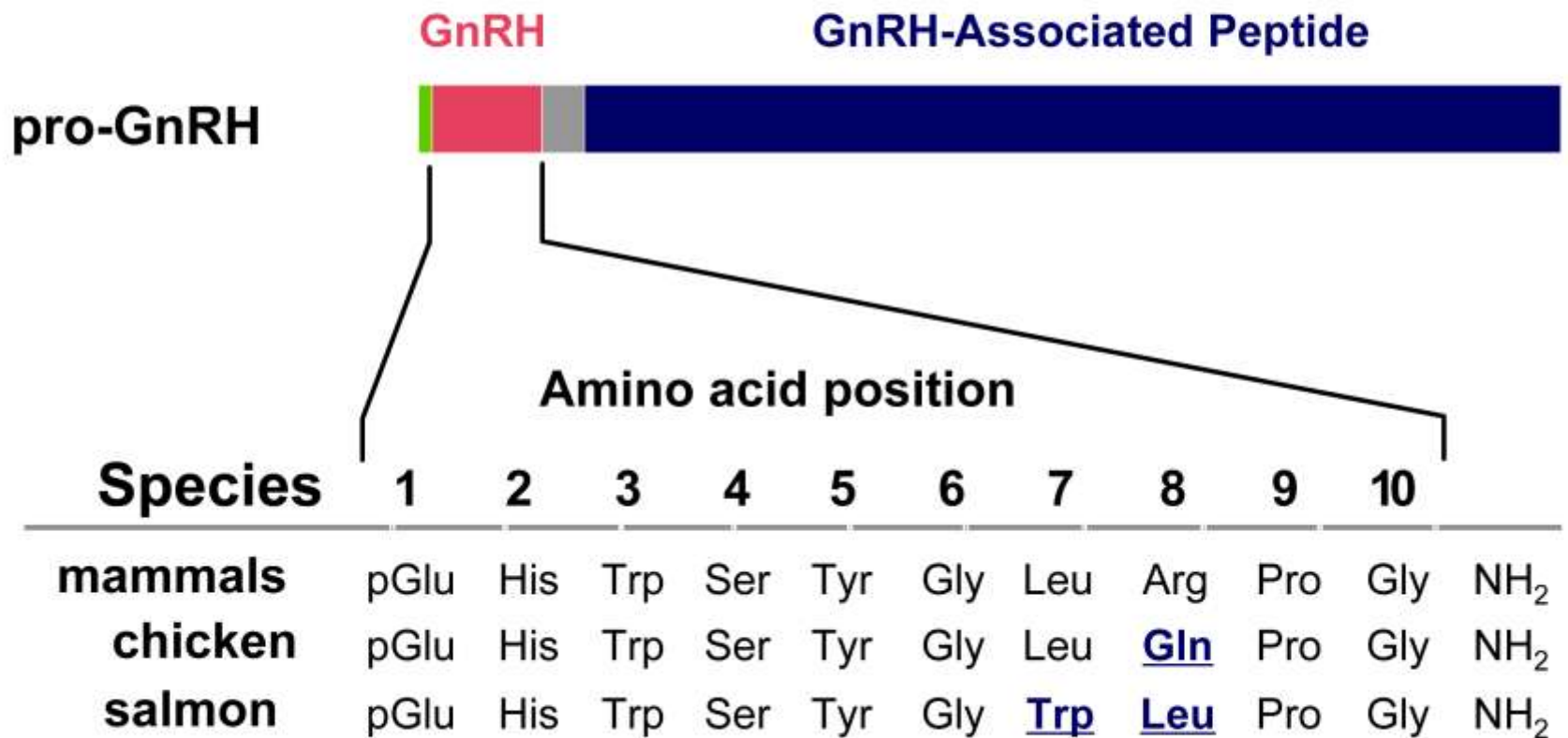
**GnRH**

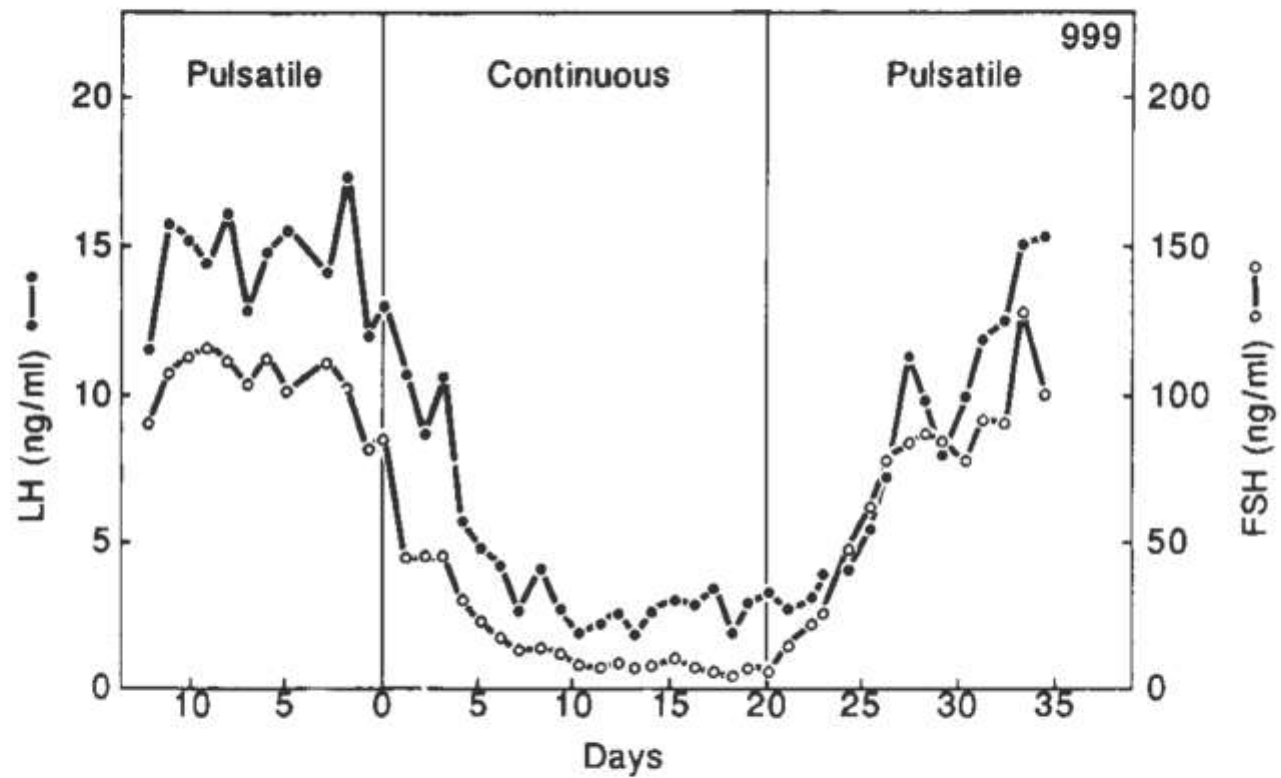
*Gonadotropin Releasing Hormone*

**Luteinizing Hormone**

**Follicle Stimulating Hormone**

# Conservation of primary structure of GnRH in vertebrates

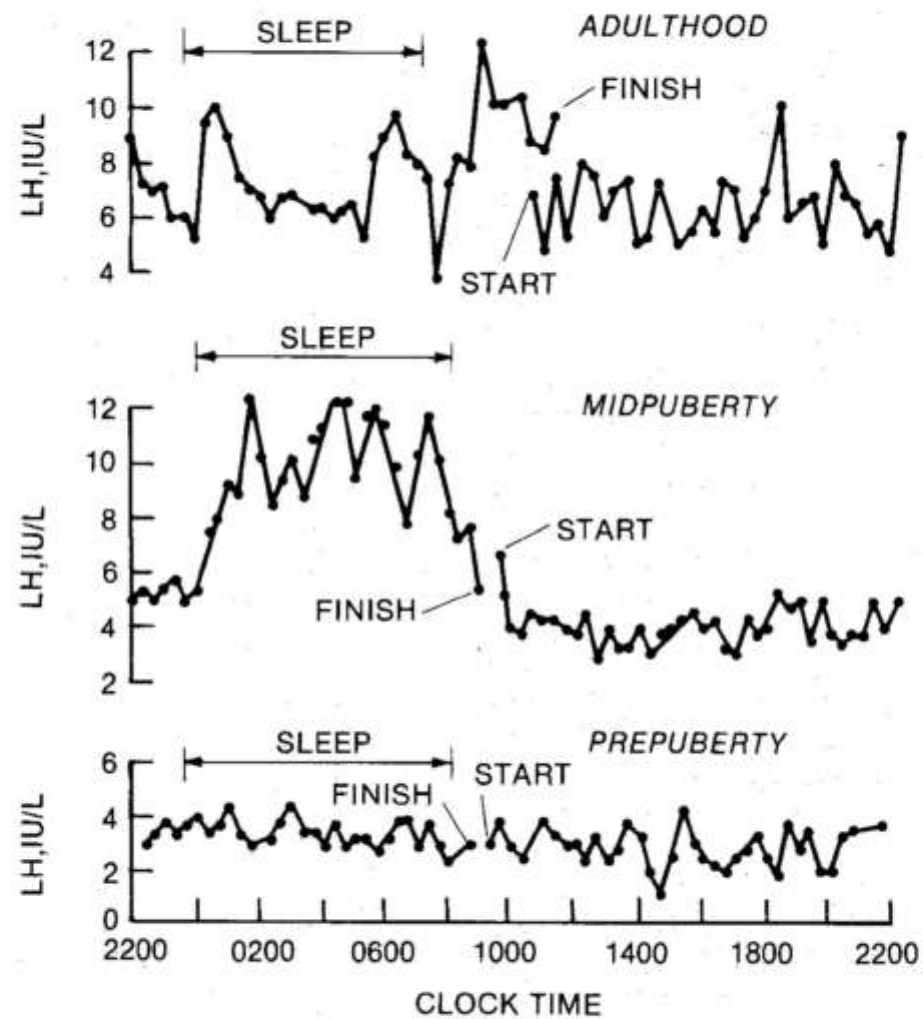


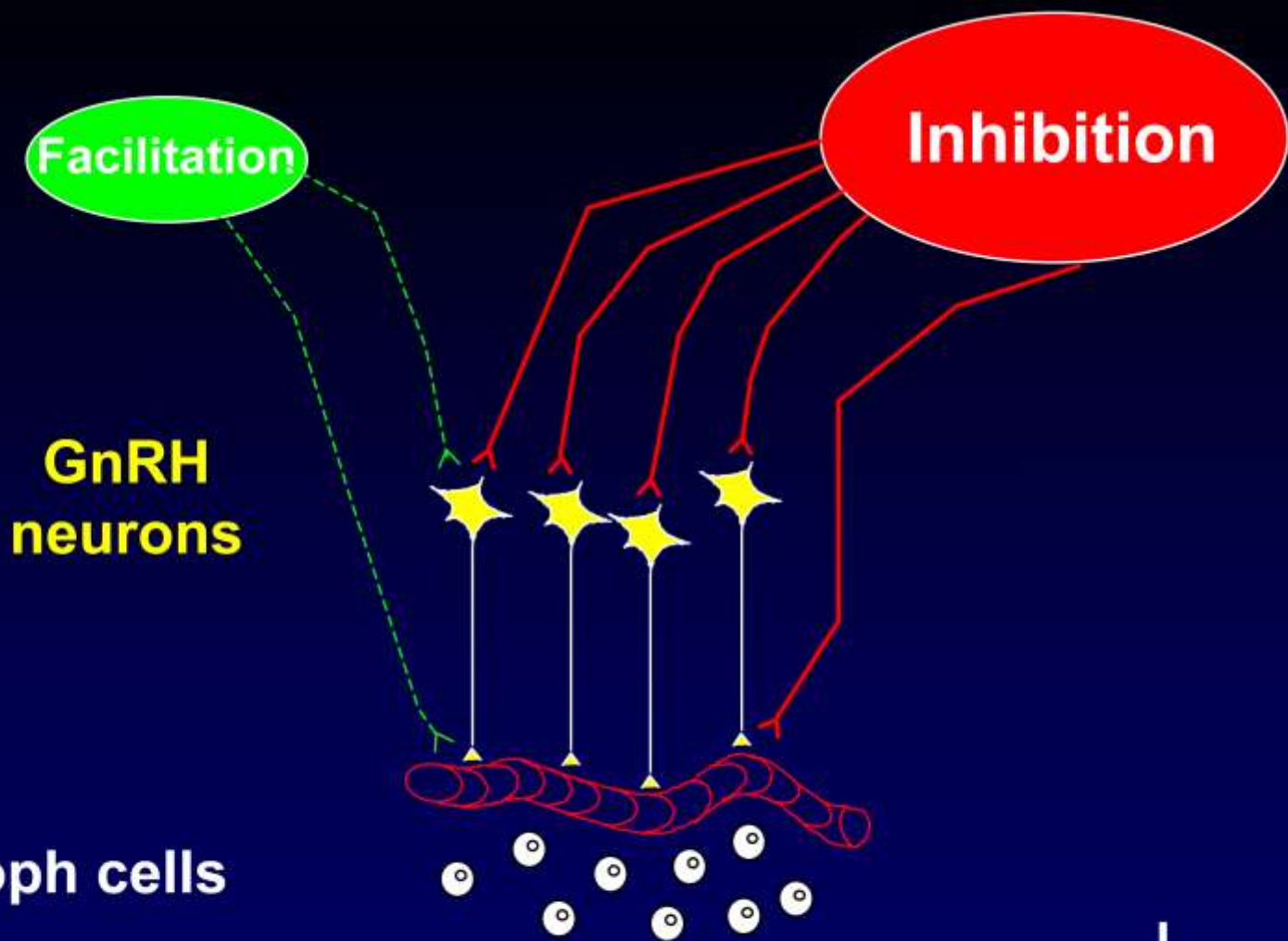


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**Belchetz et al, Science 1978;**

# Re-awakening of pulsatile GnRH secretion at puberty



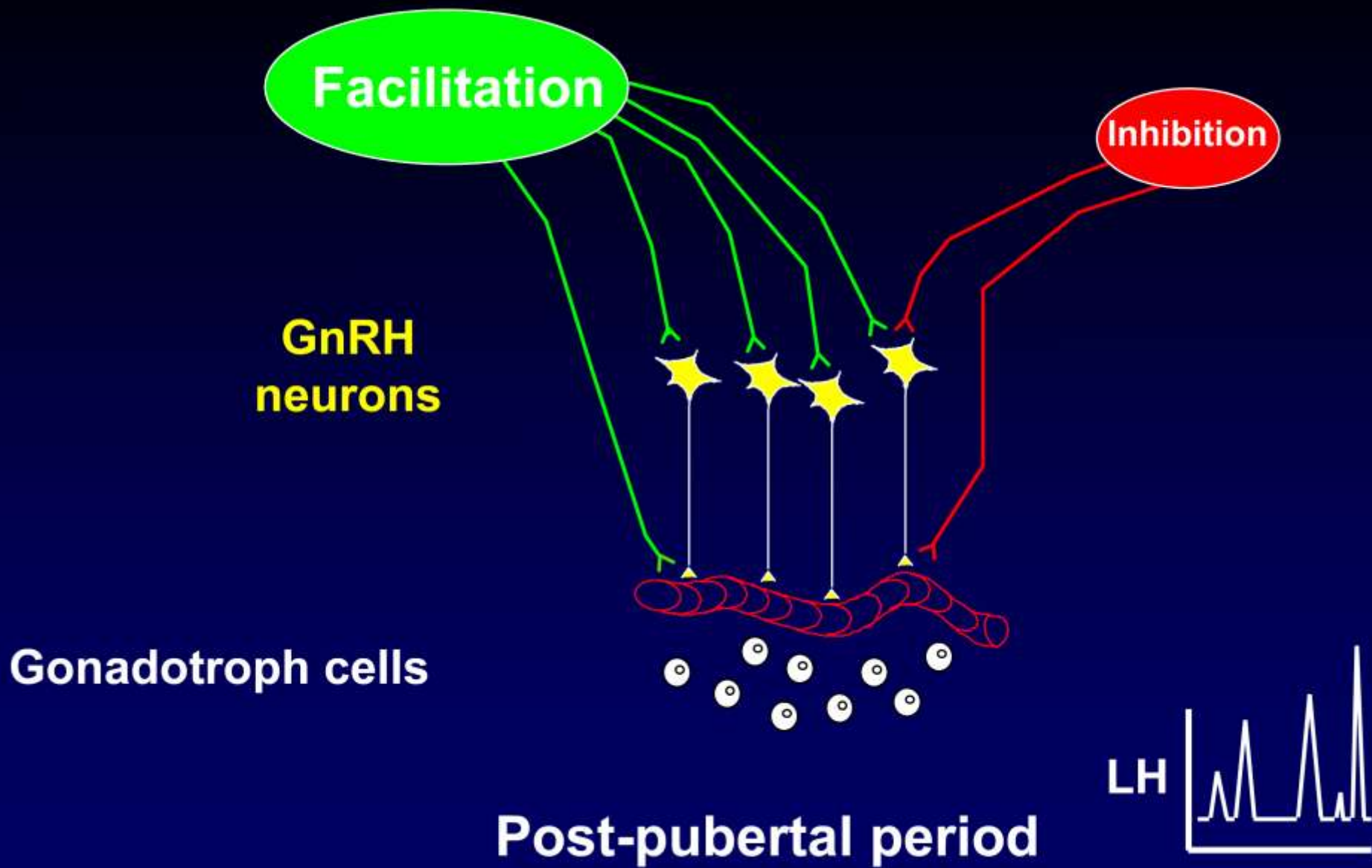


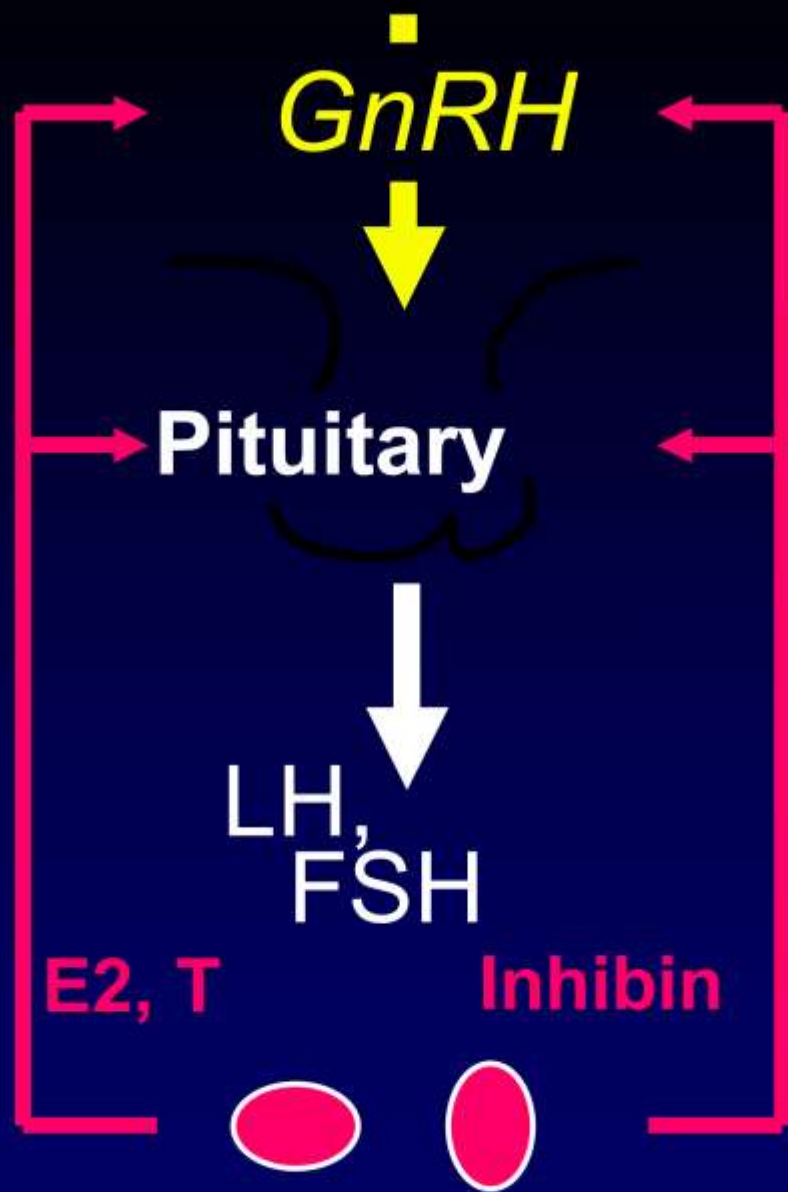
**GnRH  
neurons**

**Gonadotroph cells**

**Pre-pubertal period**

**LH**

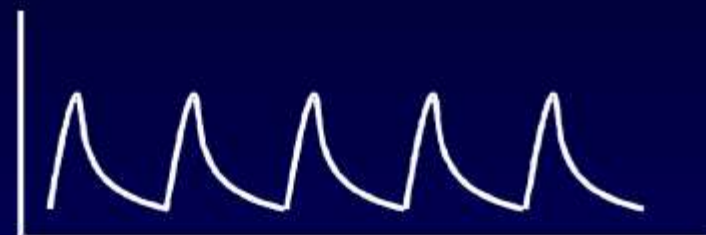




**GnRH**



**LH**



**FSH**

