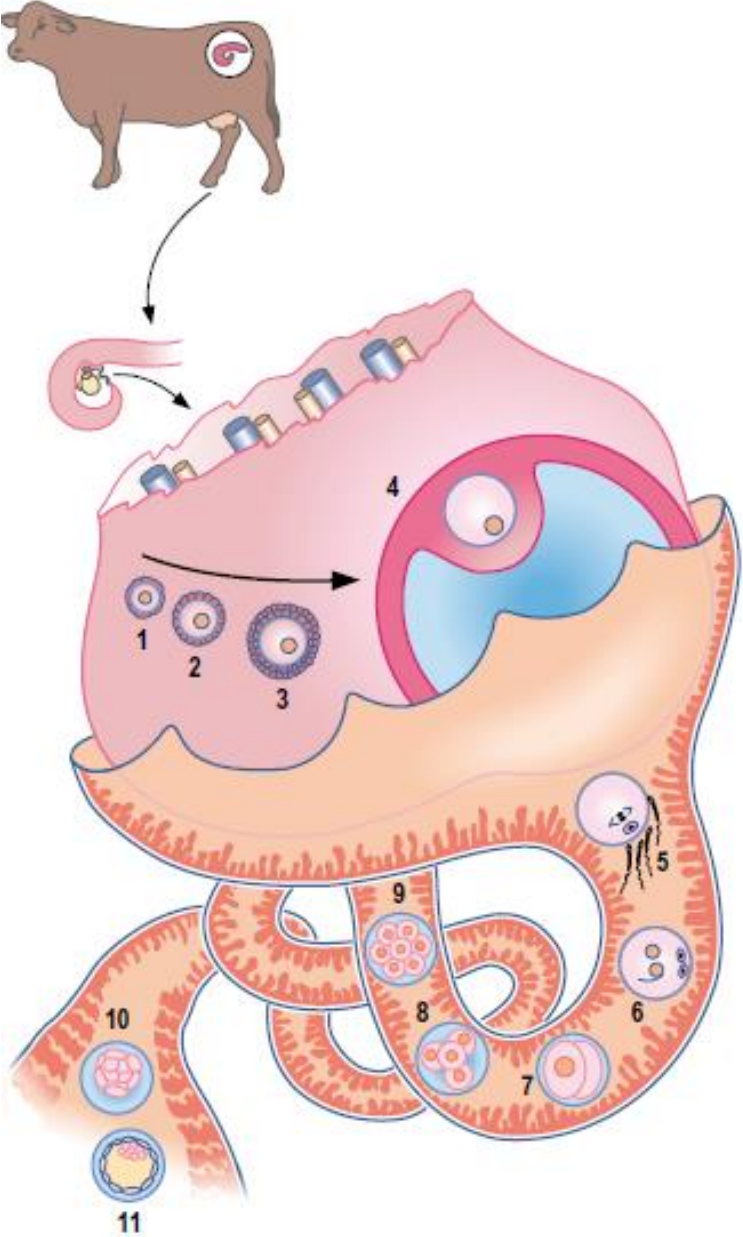
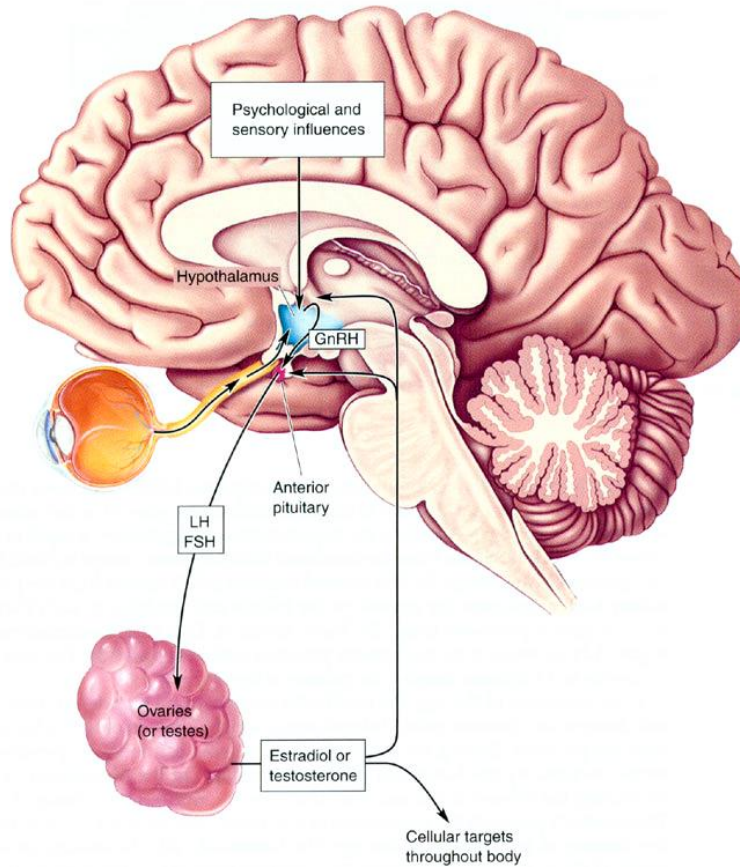


The reproductive system

THE OVARIAN CYCLE



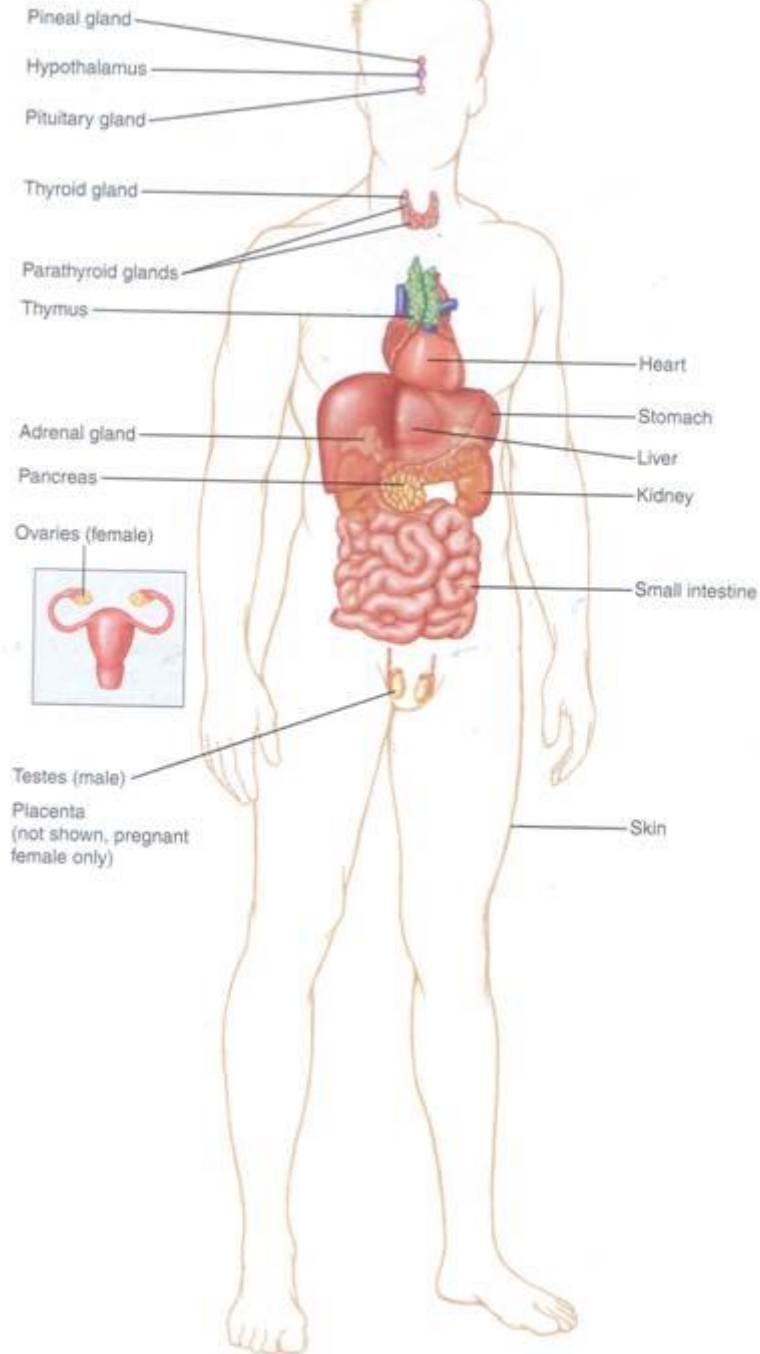
HORMONAL REGULATION OF OOGENESIS AND OVULATION



hypothalamic-pituitary-ovary axis

Primary Endocrine Organs

Secondary Endocrine Organs



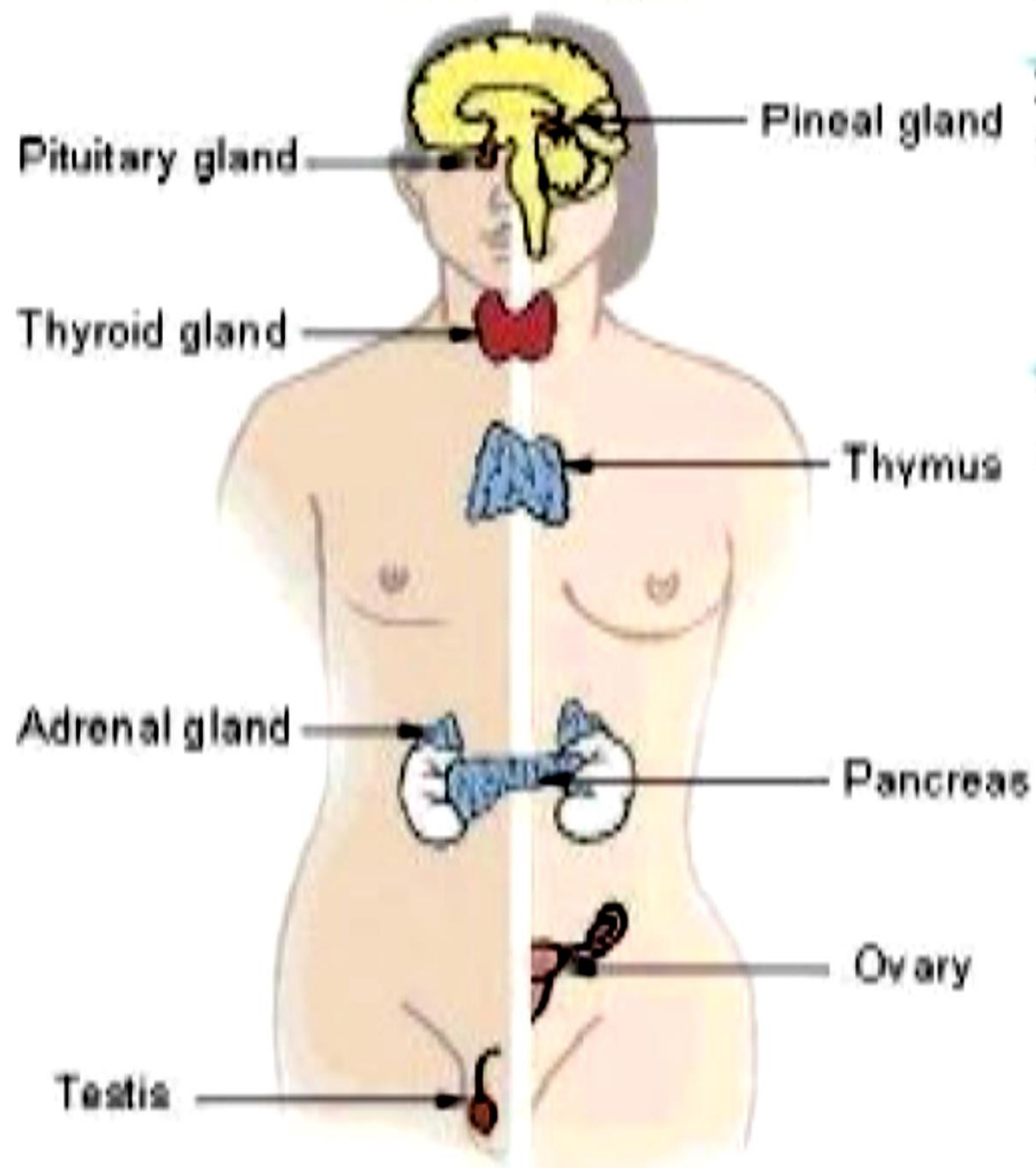
Overview of the structures of the endocrine system

Principal functions of the endocrine system

- **Maintenance of the internal environment in the body (maintaining the optimum biochemical environment)**
- **Integration and regulation of growth and development**
- **Control, maintenance and instigation of sexual reproduction, including gametogenesis, coitus, fertilization, fetal growth and development and nourishment of the newborn**

Major Endocrine Glands

Male Female



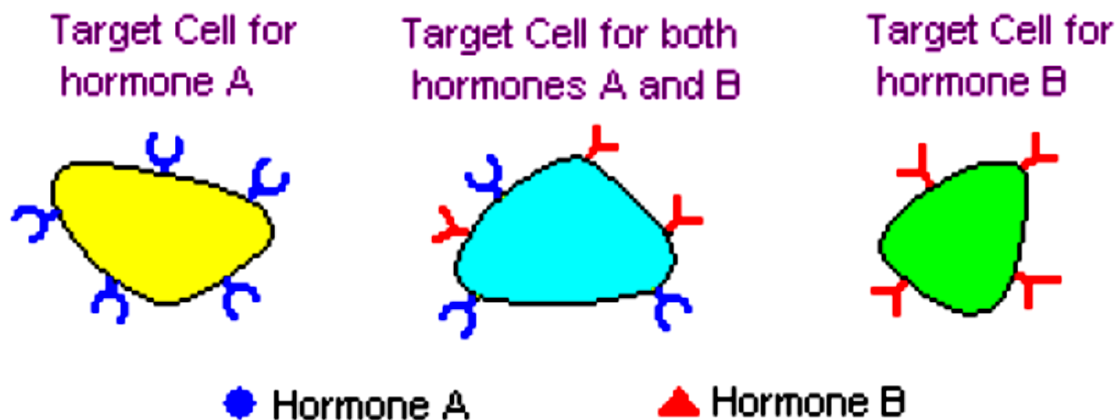
Hormones

• A chemical released from living cells that travels some distance to target tissues to have a biological effect:

- Secreted in very small amounts
- Transported, usually, in the blood
- Target cells have specific receptors

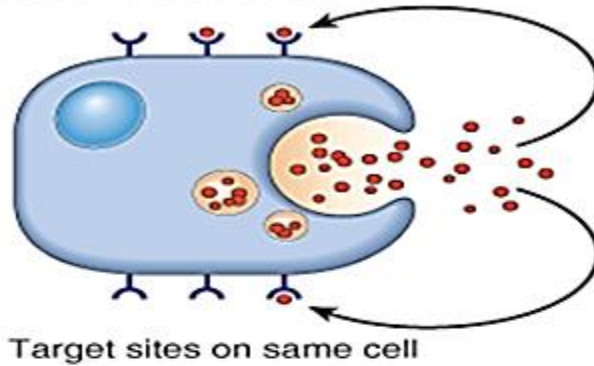
A cell is a target because it has a specific receptor for the hormone

Most hormones circulate in the blood, coming into contact with essentially all cells. However, a given hormone usually affects only a limited number of cells, which are called **target cells**. A target cell responds to a hormone because it bears **receptors** for the hormone.



Hormonal signaling

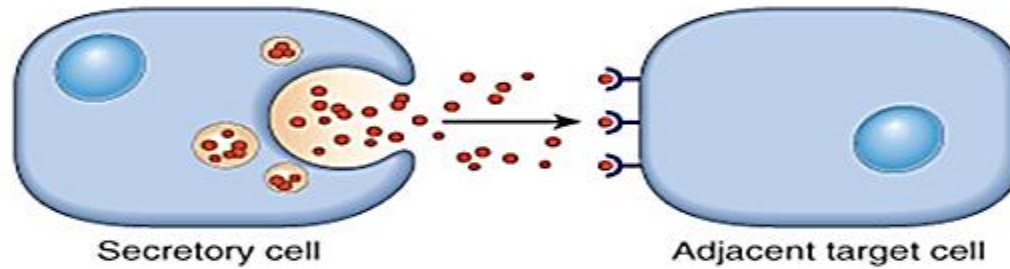
AUTOCRINE SIGNALING



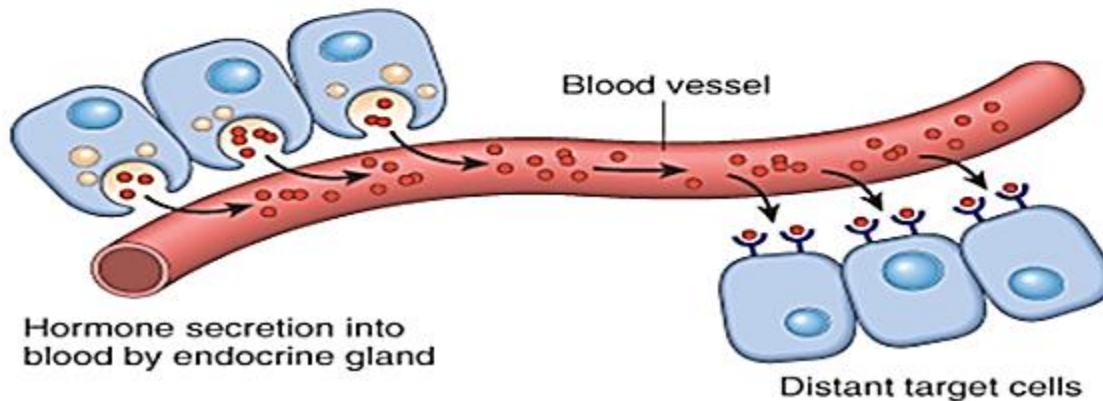
● Extracellular signal

Y Receptor

PARACRINE SIGNALING



ENDOCRINE SIGNALING



Hormone Chemistry

Most commonly, hormones are categorized into three structural groups:

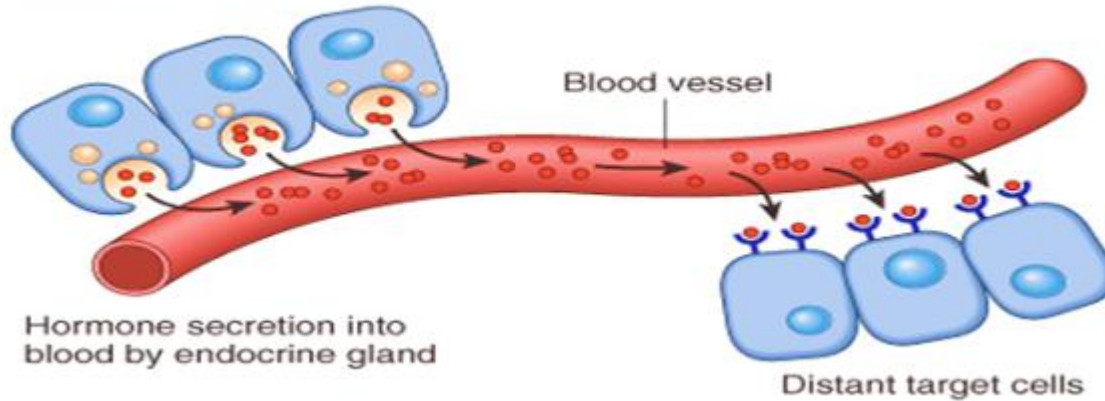
Peptides and proteins

Steroids

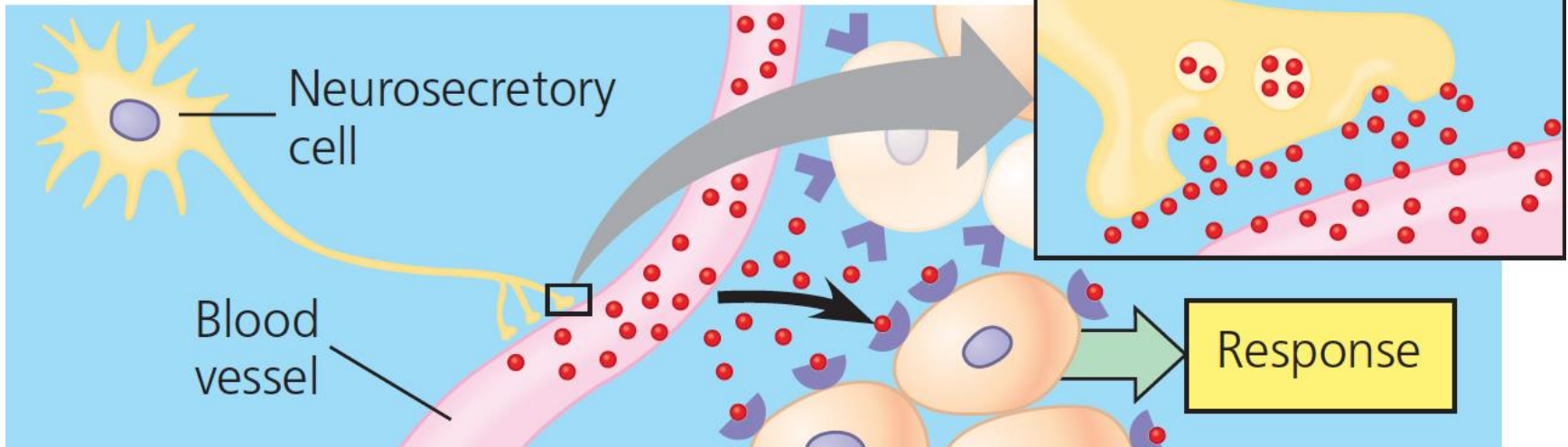
Fatty acid derivatives

Types of hormonal communication

ENDOCRINE SIGNALING



neuroendocrine communication



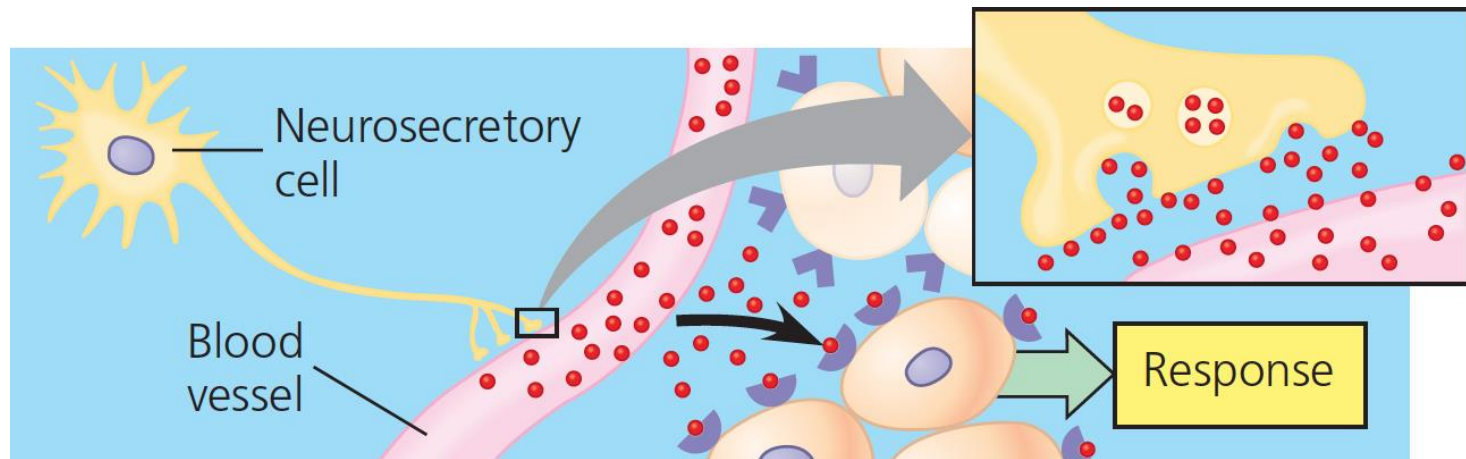
NEUROENDOCRINE RELATIONS

We usually contrast nervous system structures with endocrine structures. But...

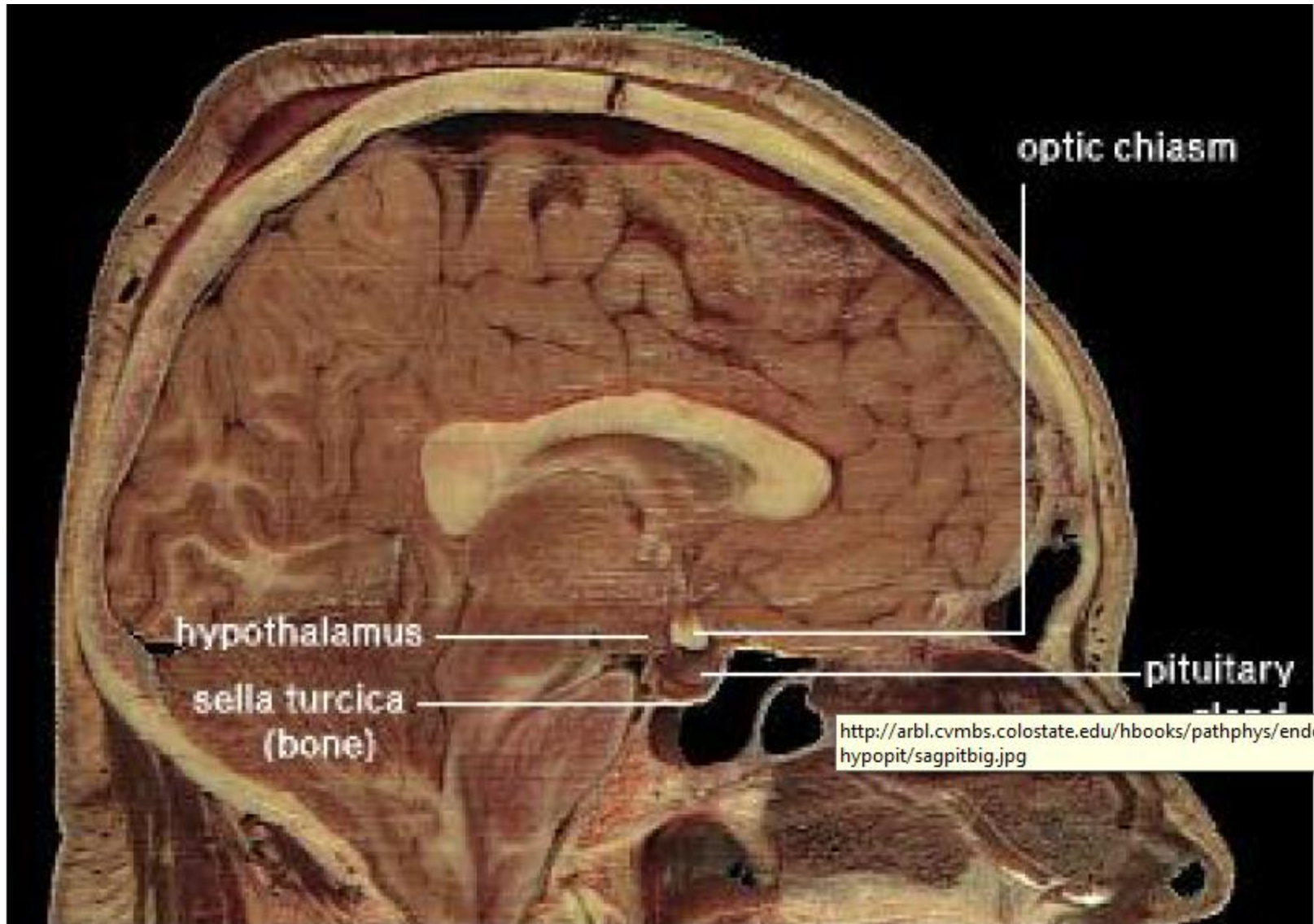
...certain nervous system cells act as endocrine cells.

Nerve cells that produce hormones and secrete them into the bloodstream are called **NEUROSECRETORY CELLS**.

Neurosecretory cells are found in the **HYPOTHALAMUS**.



HYPOTHALAMUS



Hypothalamus

- **Integrates functions that maintain chemical and temperature homeostasis**
- **Functions with the limbic system**
- **Controls the release of hormones from the anterior and posterior pituitary**

Hypothalamus

- **Synthesizes releasing hormones in cell bodies of neurons**
- **Hormones are transported down the axon and stored in the nerve endings**
- **Hormones are released in pulses**

Hypothalamic Releasing Hormones

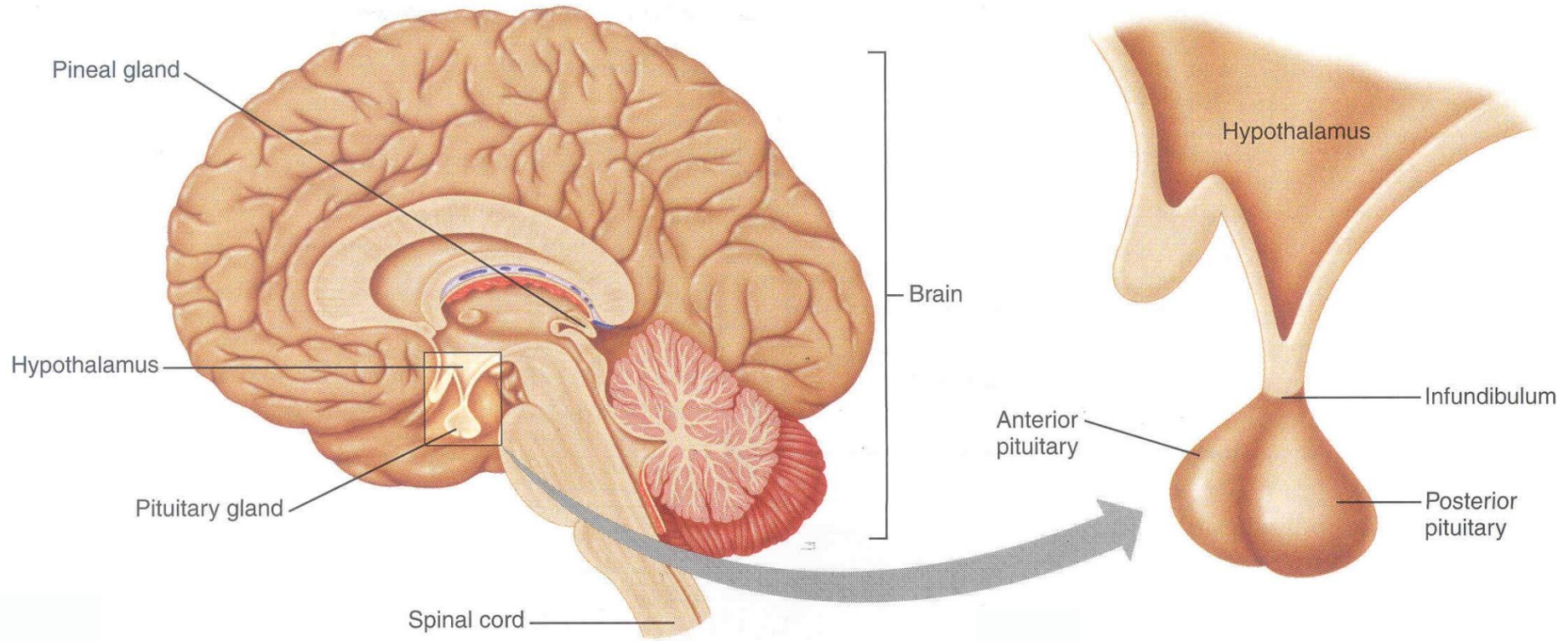
Seven releasing hormones are made in the hypothalamus

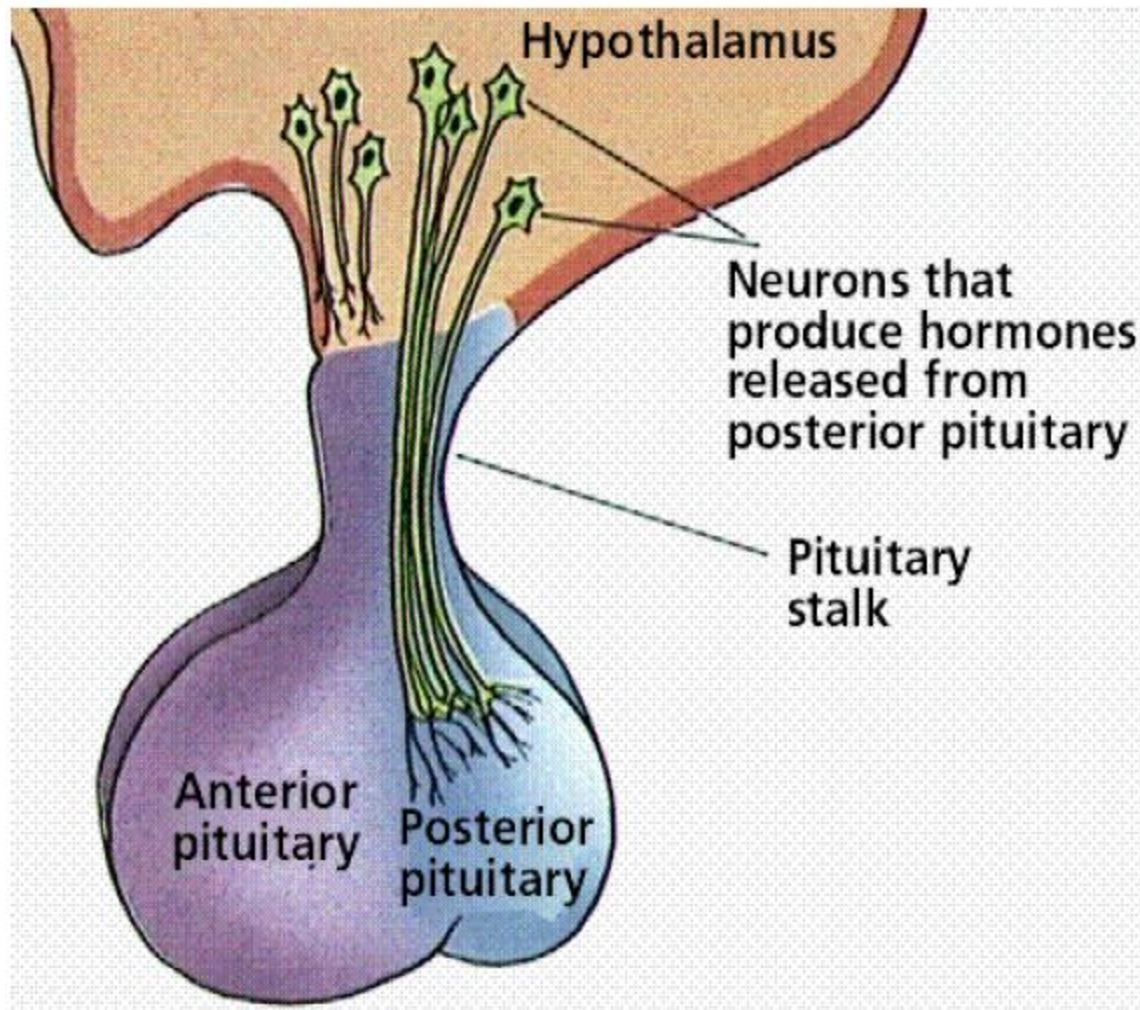
- Thyrotropin-releasing hormone (TRH)
- Corticotropin-releasing hormone (CRH)
- **Gonadotropin-releasing hormone (GnRH)**
- Growth hormone-releasing hormone (GHRH)
- Growth hormone-release inhibiting hormone (GHIH)
- Prolactin-releasing factor (PRF)
- Prolactin-inhibiting hormone (PIH)

Hypothalamus Releasing Hormones: Secretion

- Is influenced by emotions
- Can be influenced by the metabolic state of the individual
- Delivered to the anterior pituitary via the hypothalamic-hypophyseal portal system

PITUITARY GLAND (HYPOPHYSIS)





Frontal view of a pig
pituitary gland and
hypothalamus



Anterior Pituitary

Is also called the Adenohypophysis

Secretes tropic hormones in a pulsatile fashion

**Synthesizes various hormones in various
specific cell populations**

Anterior Pituitary Hormones

Each of anterior pituitary hormone is synthesized by a cell population.

Corticotropes - ACTH

Lactotropes - Prolactin

Somatotropes - GH

Thyrotropes - Thyrotropin

Gonadotropes - FSH, LH

ANTERIOR PITUITARY GLAND HORMONES

GROWTH HORMONE (GH) – regulates growth; affects protein, fat and carbohydrate metabolism.

THYROID STIMULATING HORMONE (TSH) – controls secretion of thyroxin.

ADRENOCORTICOTROPIC HORMONE (ACTH) – controls secretion of hormones released by adrenal cortex.

FOLLICLE-STIMULATING HORMONE (FSH) – in females, stimulates maturation of egg cells and estrogen secretion by ovaries.

LUTENIZING HORMONE (LH) – in males, stimulates secretion of testosterone and sperm production by testes. In females, stimulates release of ovum by ovary.

MELANOCYTE-STIMULATING HORMONE (MSH) – along with ACTH, affects pigment release in skin.

PROLACTIN (PRL) – stimulates milk production.

Anterior Pituitary Hormones

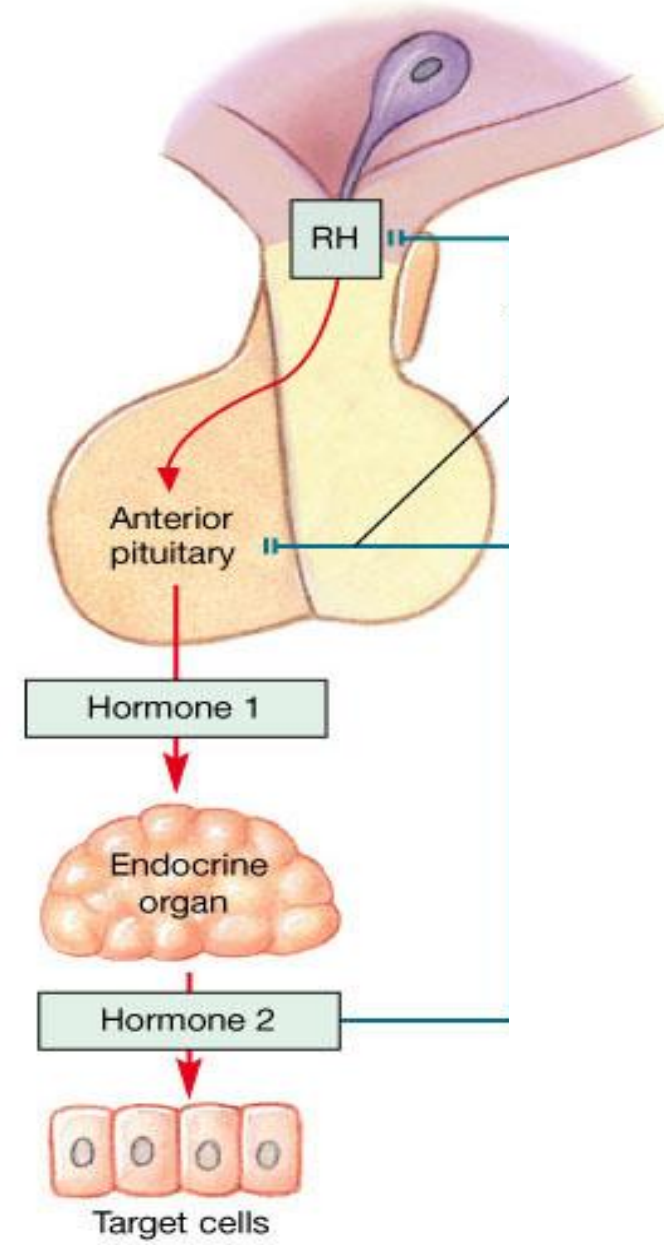
Follicle-stimulating Hormone (FSH): **Females**: stimulates growth & development of ovarian follicles, promotes secretion of estrogen by ovaries. **Males**: required for sperm production

Luteinizing Hormone (LH): **Females**: responsible for ovulation, formation of corpus luteum in the ovary, and regulation of ovarian secretion of female sex hormones. **Males**: stimulates cell in the testes to secrete testosterone

Prolactin: **Females**: stimulates breast development and milk production. **Males**: involved in testicular function

Most hormonal interactions of the hypothalamus-pituitary complex follow a common pattern:

1. A hypothalamic hormone effects control over the secretion of an anterior pituitary hormone;
2. The corresponding anterior pituitary hormone controls secretion of the hormone of another endocrine gland; and
3. That secretion of that gland affects other target tissues/organs.

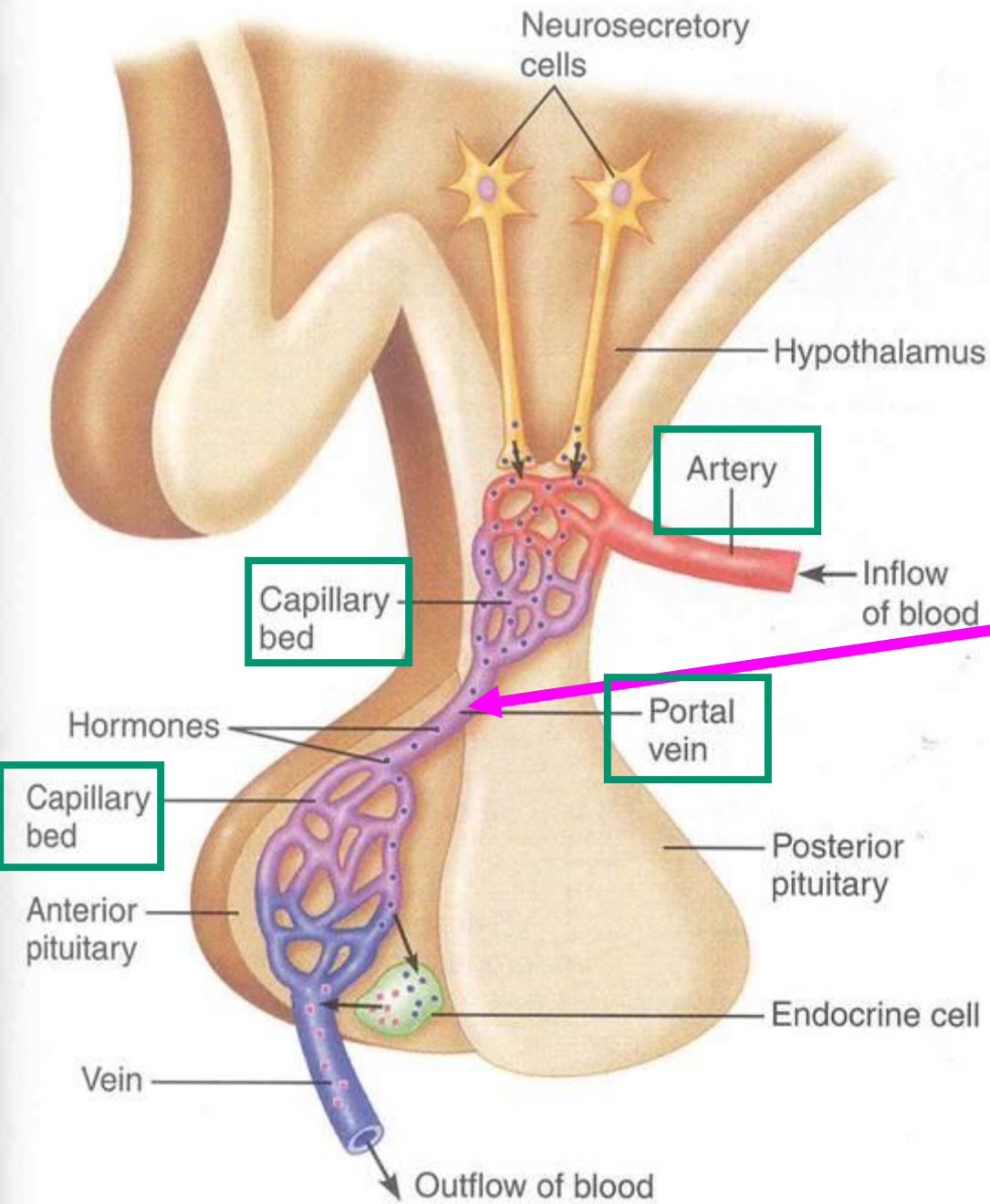


HYPOTHALAMUS HORMONES (FUNCTION)

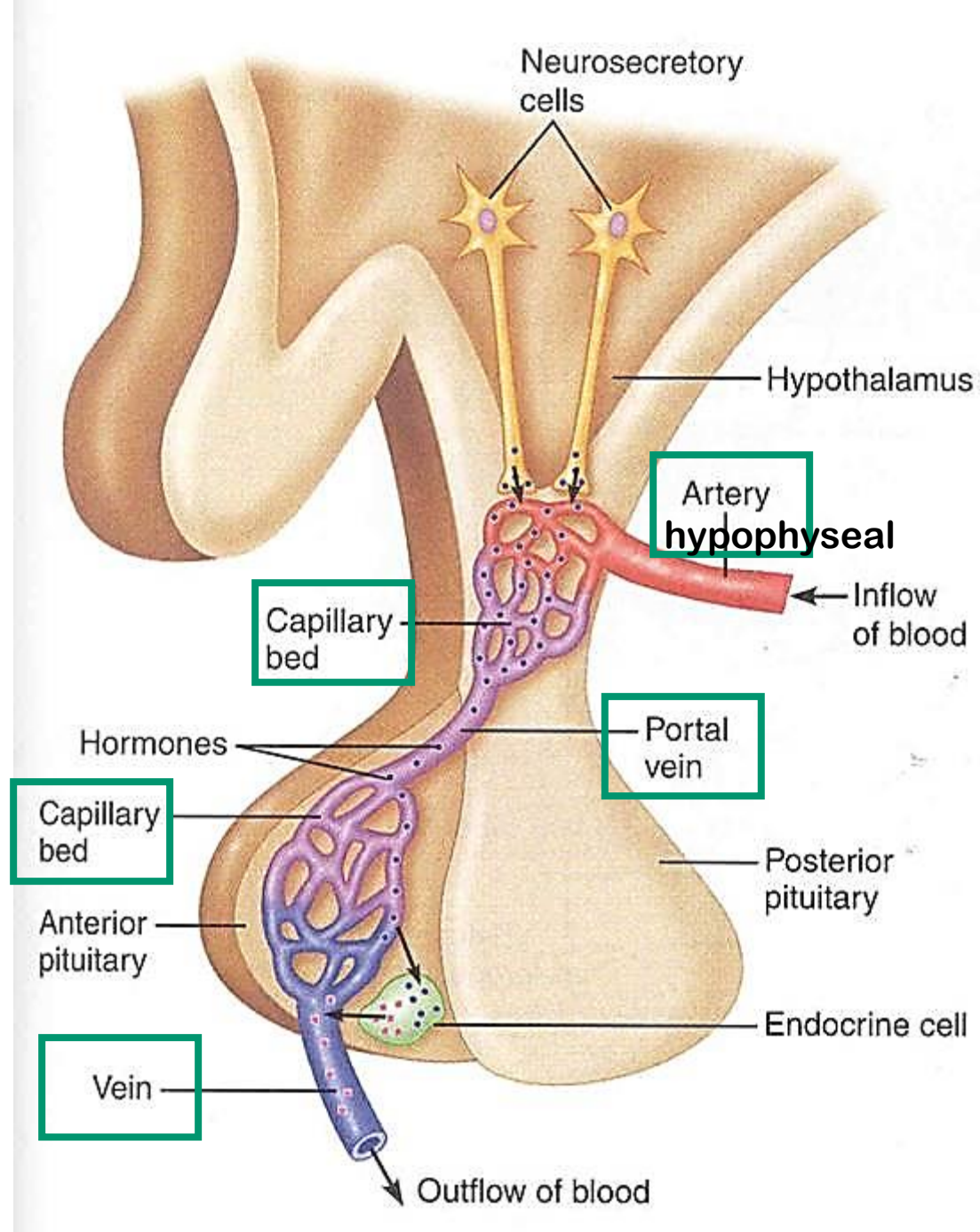
So...

Hypothalamic hormones can have effect of stimulating or inhibiting the release of anterior pituitary hormones.

Called RELEASING HORMONES (“RH”) or INHIBITING HORMONES (“IH”) respectively.



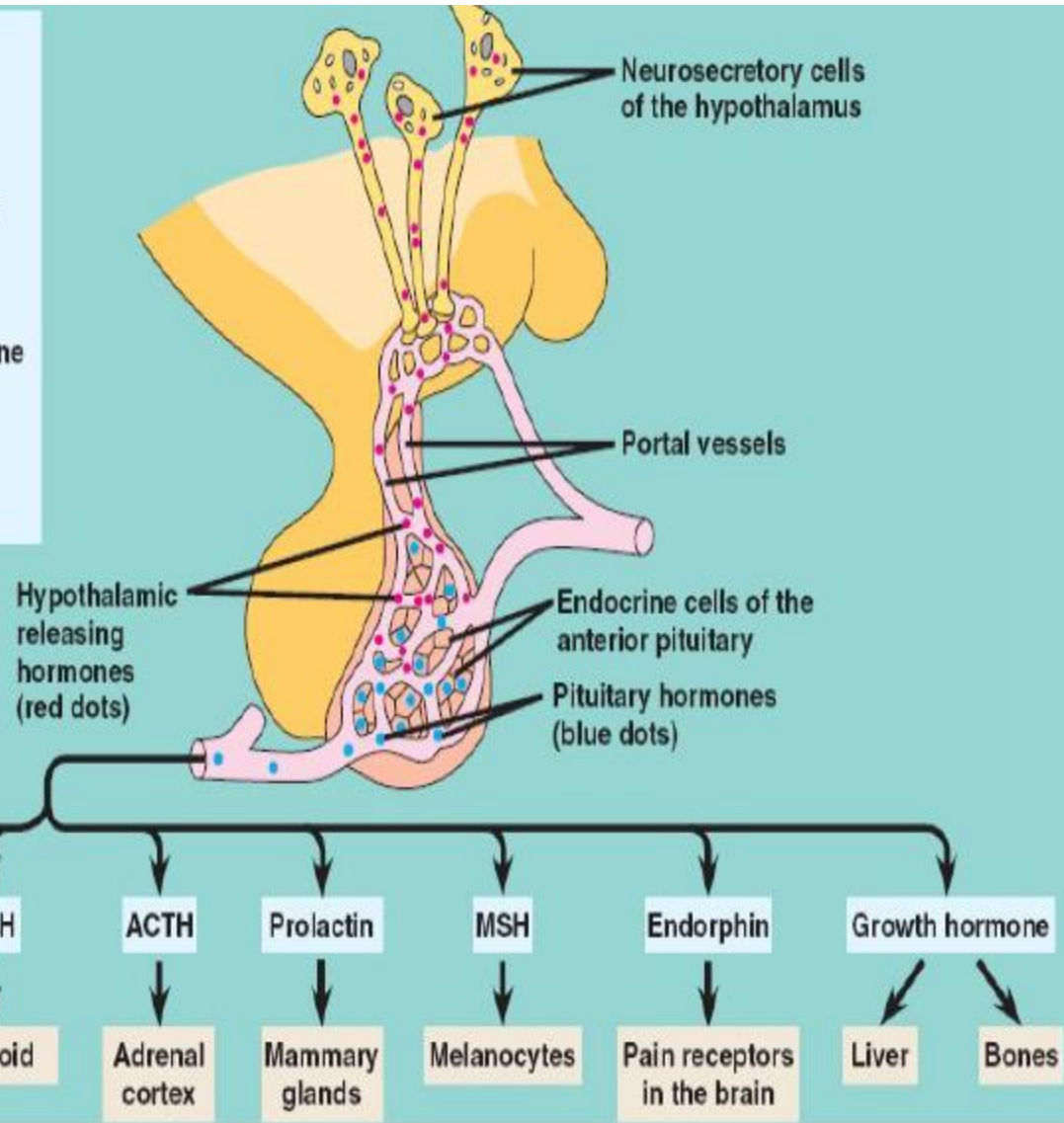
Portal Vascular System!!



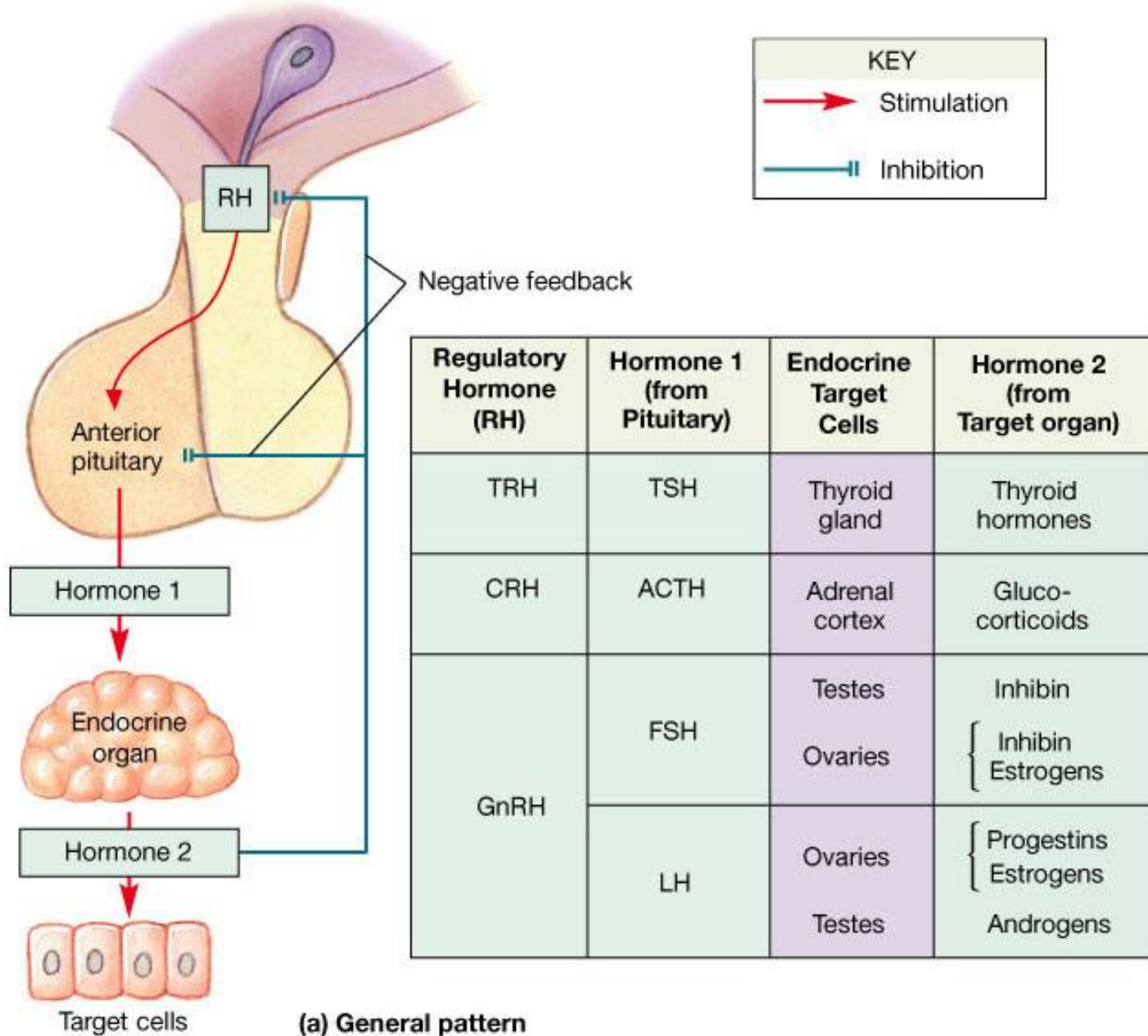
Tropic Effects Only
 FSH, follicle-stimulating hormone
 LH, luteinizing hormone
 TSH, thyroid-stimulating hormone
 ACTH, adrenocorticotropic hormone

Nontropic Effects Only
 Prolactin
 MSH, melanocyte-stimulating hormone
 Endorphin

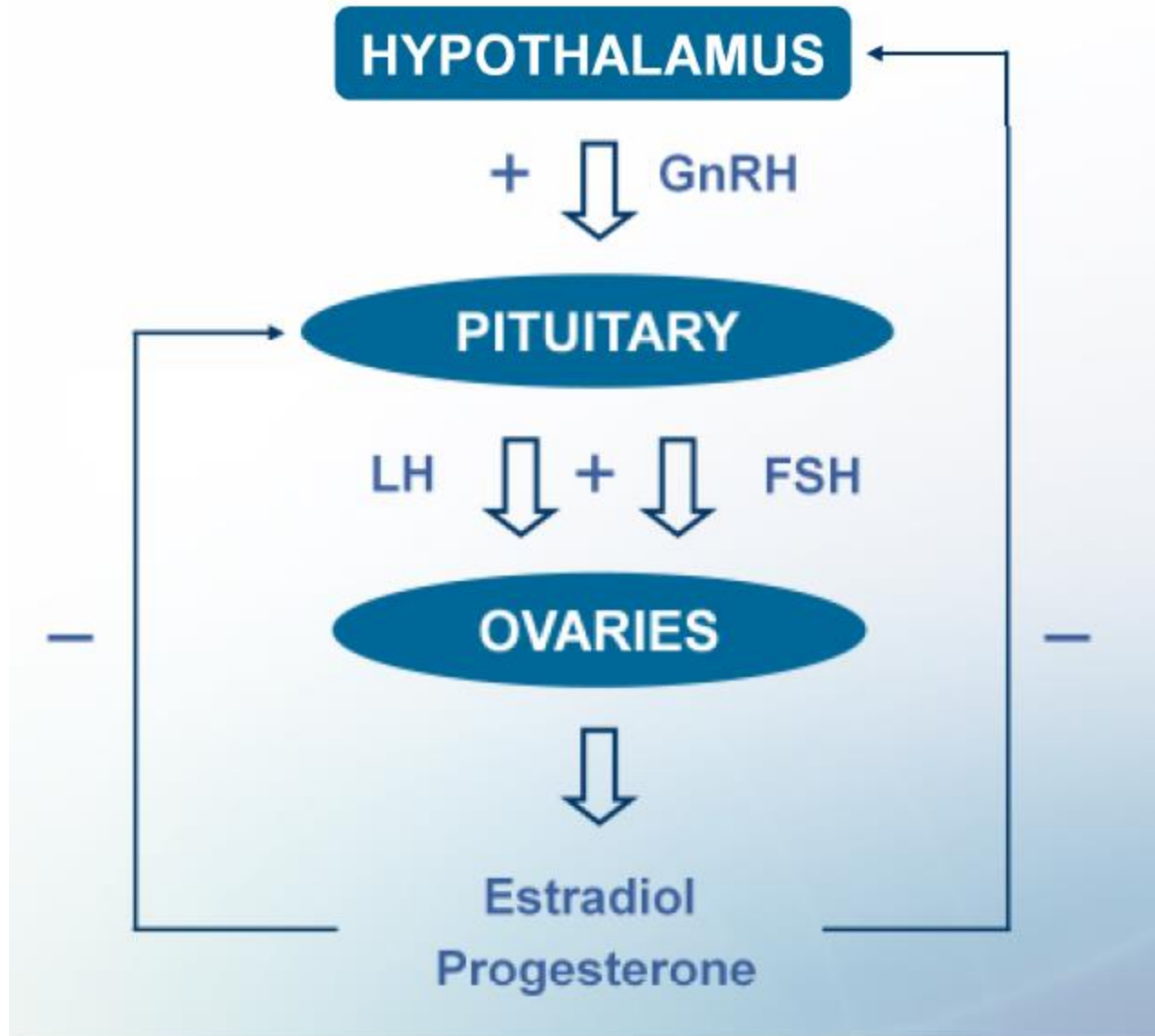
Nontropic and Tropic Effects
 Growth hormone

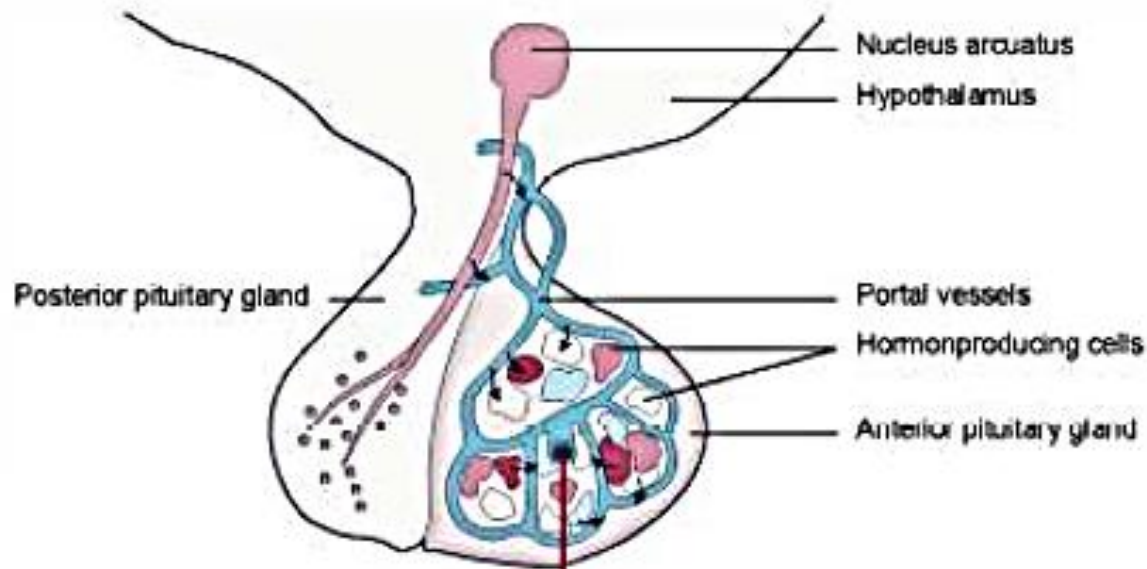


Feedback control mechanisms

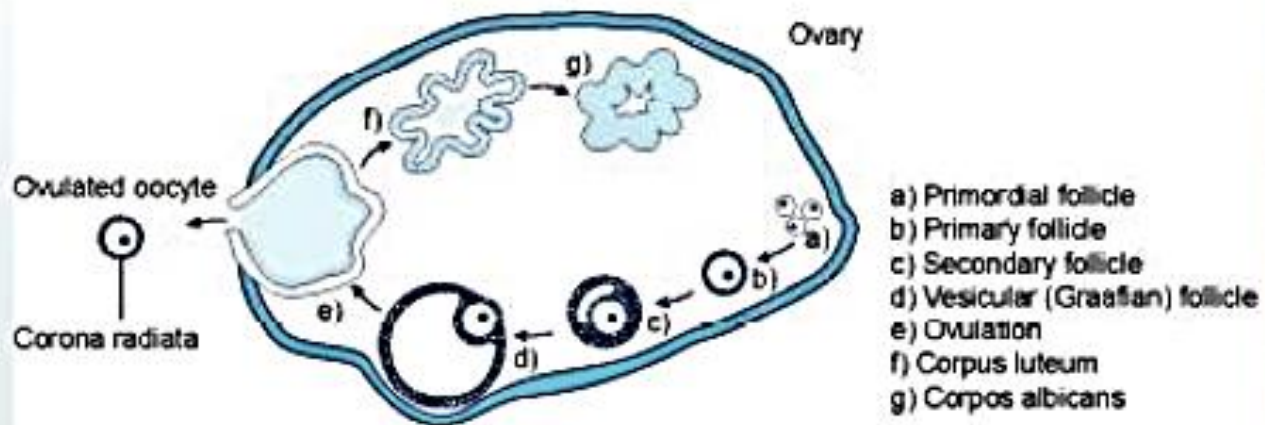


Female reproductive axis





FSH & LH



Establishing the Ovarian Cycle

- During childhood, ovaries grow and secrete small amounts of estrogens that inhibit hypothalamic release of GnRH
- As puberty nears, GnRH released; FSH and LH released by pituitary, and act on ovaries
- These events continue until an adult cyclic pattern achieved and menarche occurs