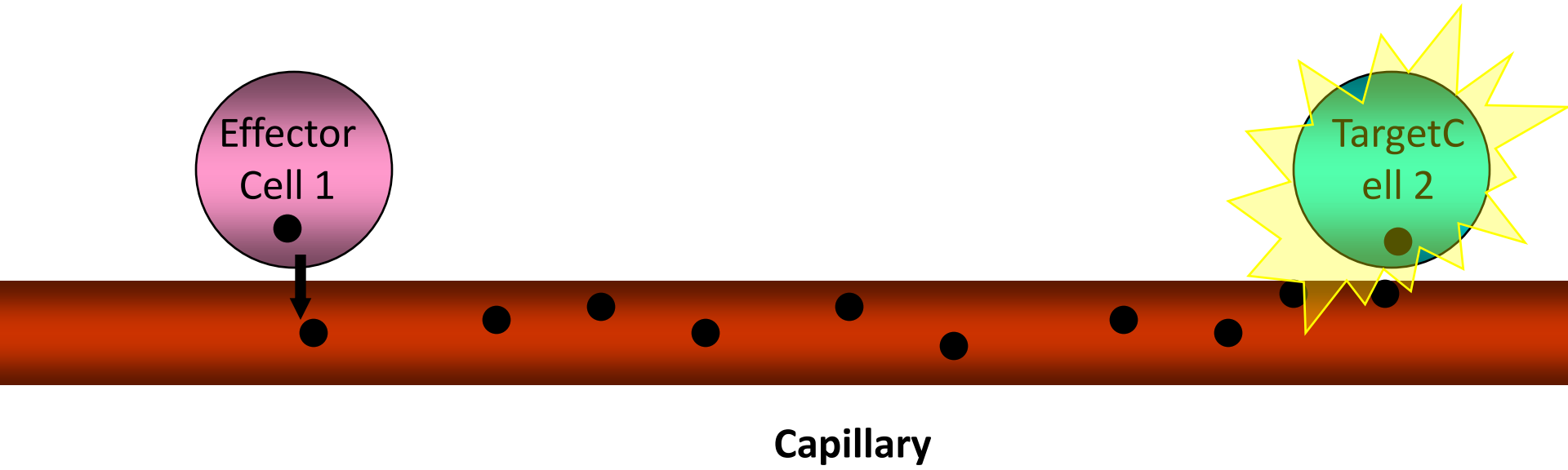
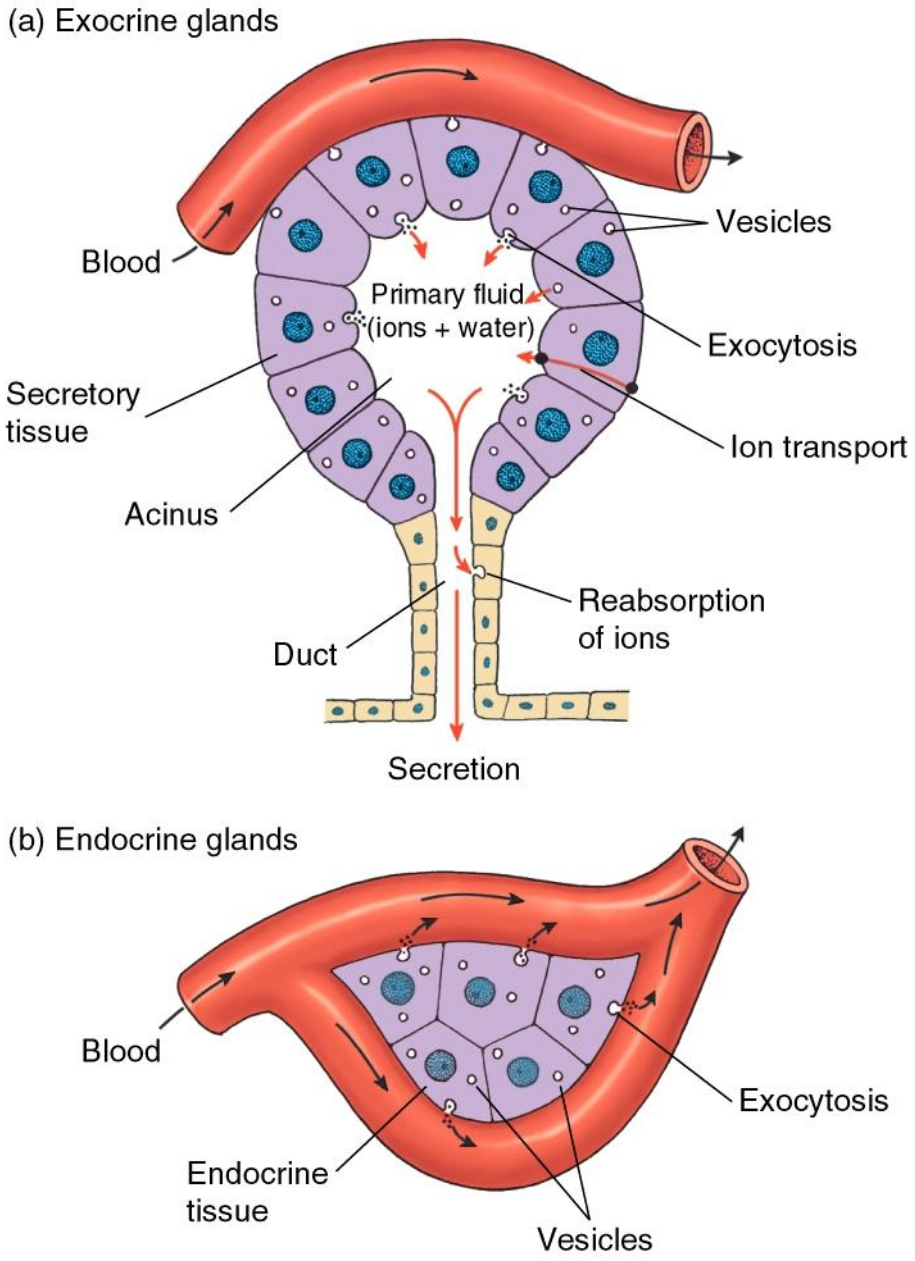
ENDOCRINE GLANDS

SECRETION
AND
ACTION OF HORMONES

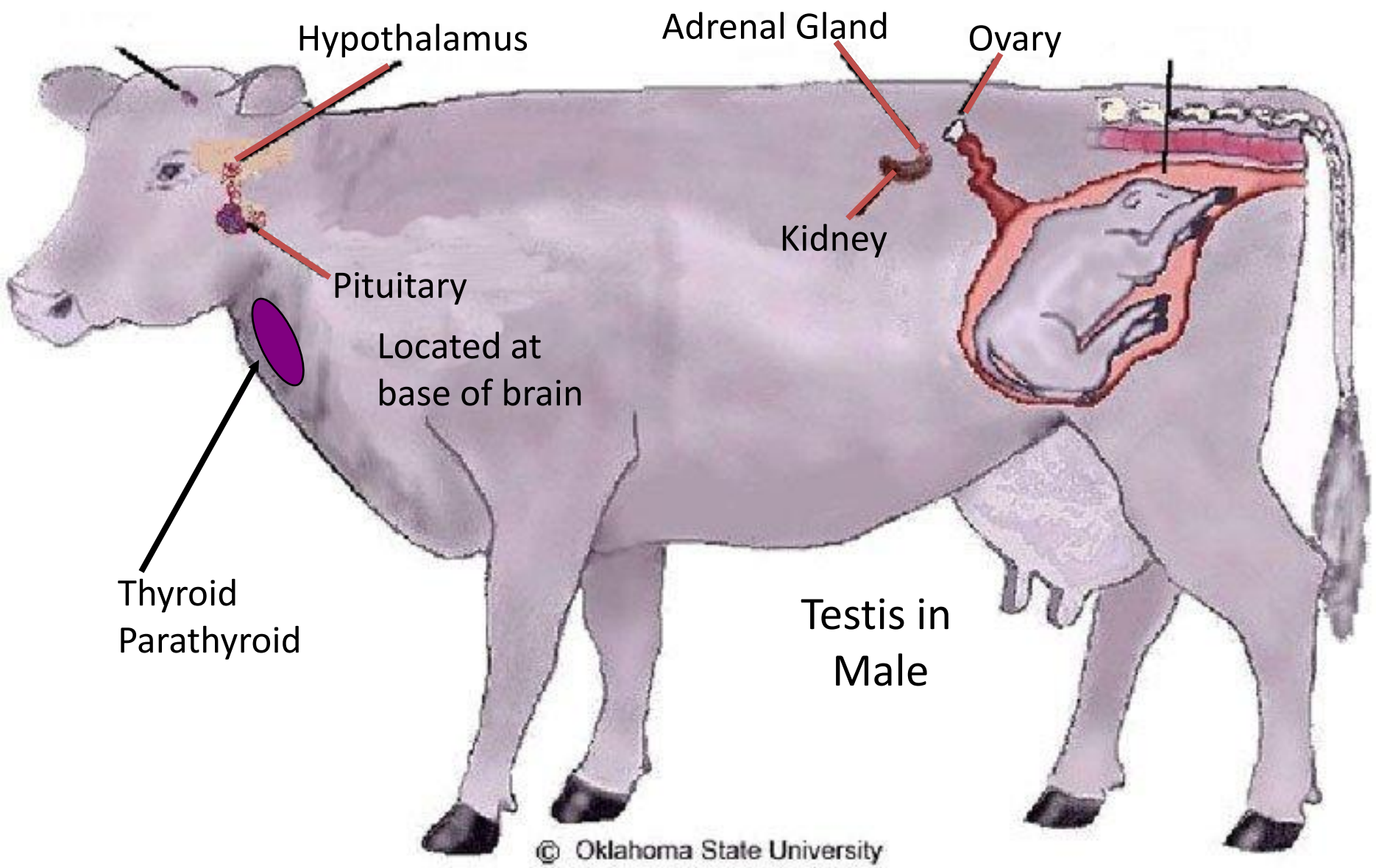
Classic Definition of a Hormone

- **<u>Hormone</u> - Chemical messenger produced by a ductless gland or tissue and carried in the blood/lymph to a target organ where it effects a change in cellular activity.**

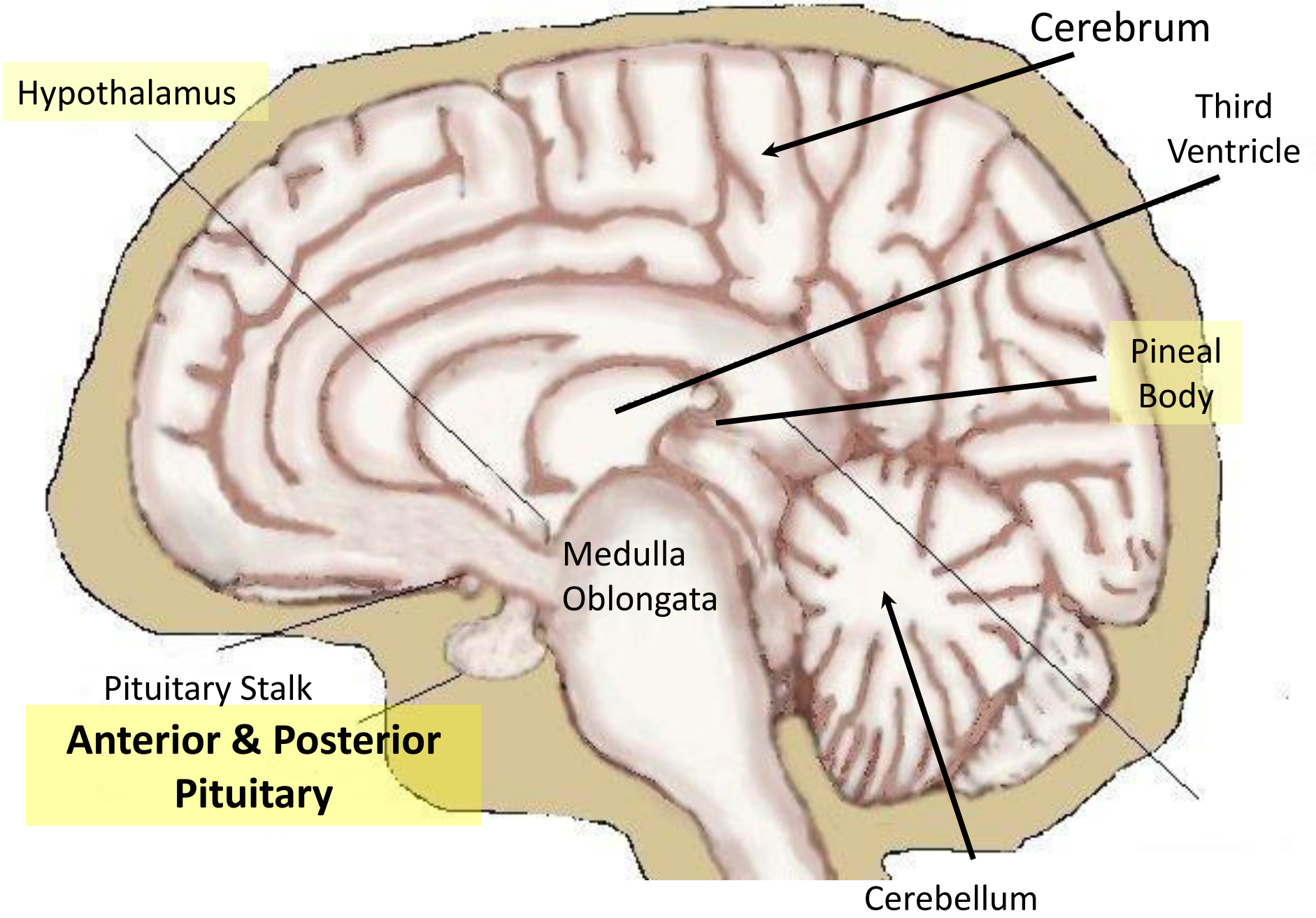


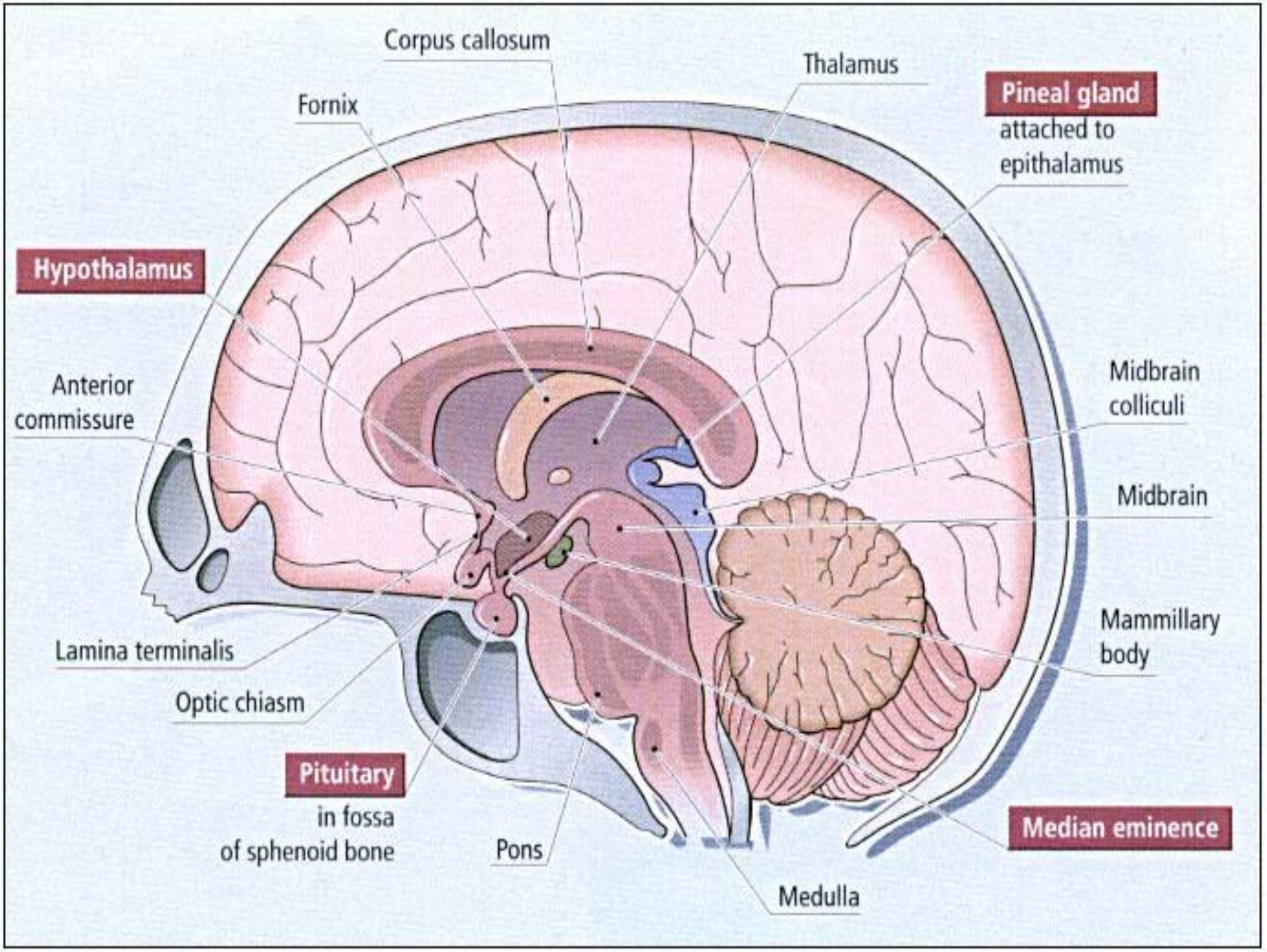

(a) Exocrine glands
Blood
Vesicles
Primary fluid
(ions + water)
Exocytosis
Secretory
tissue
Ion transport
Acinus
Reabsorption
of ions
Duct
Secretion
(b) Endocrine glands
Blood
Exocytosis
Endocrine
tissue
Vesicles

Endocrine Glands

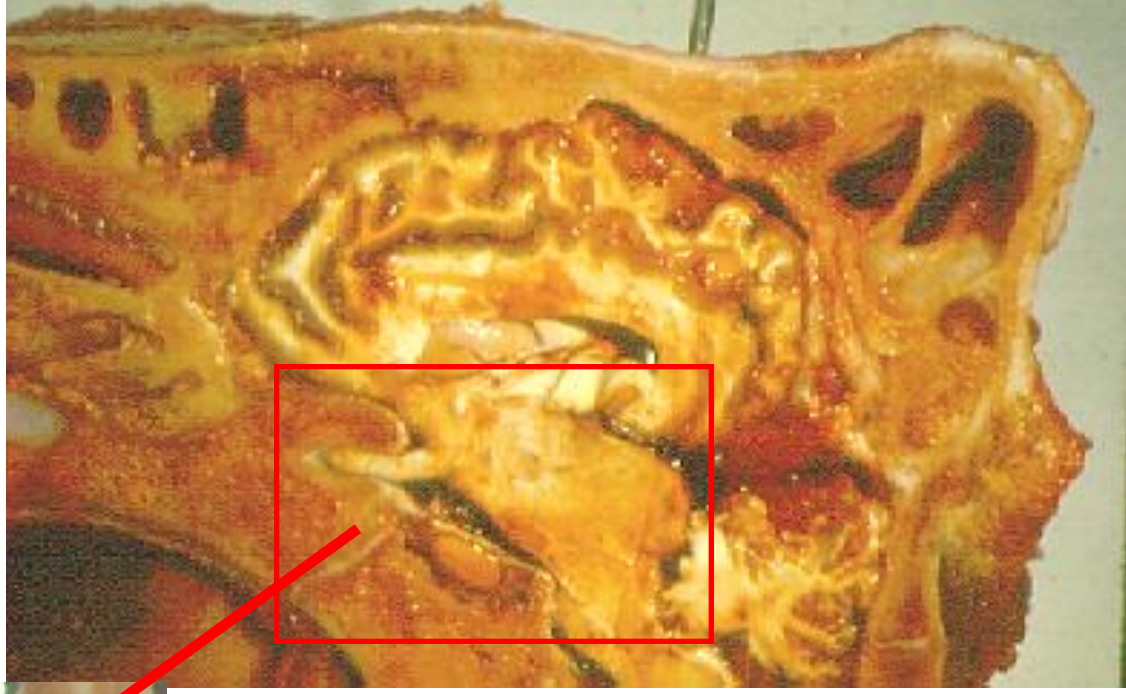


Higher Centers of Brain Control All Hormonal Functions

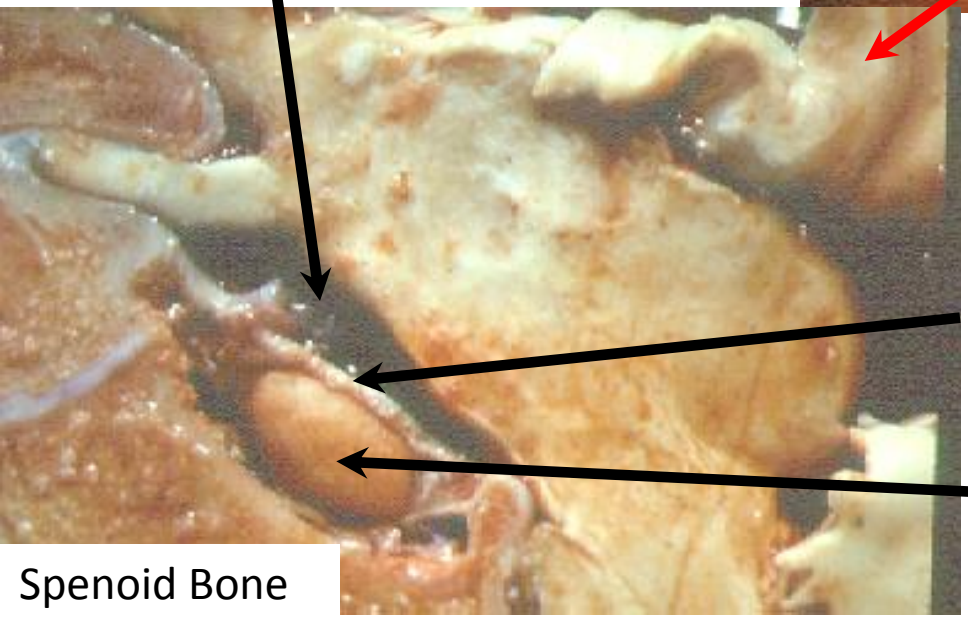



Corpus callosum
Thalamus
Fornix
Pineal gland
attached to
epithalamus
Hypothalamus
Anterior
commissure
Midbrain
colliculi
Midbrain
Mammillary
body
Lamina terminalis
Optic chiasm
Pituitary
in fossa
of sphenoid bone
Pons
Medulla
Median eminence

Anatomy of Cow Brain



Infundibular Stalk



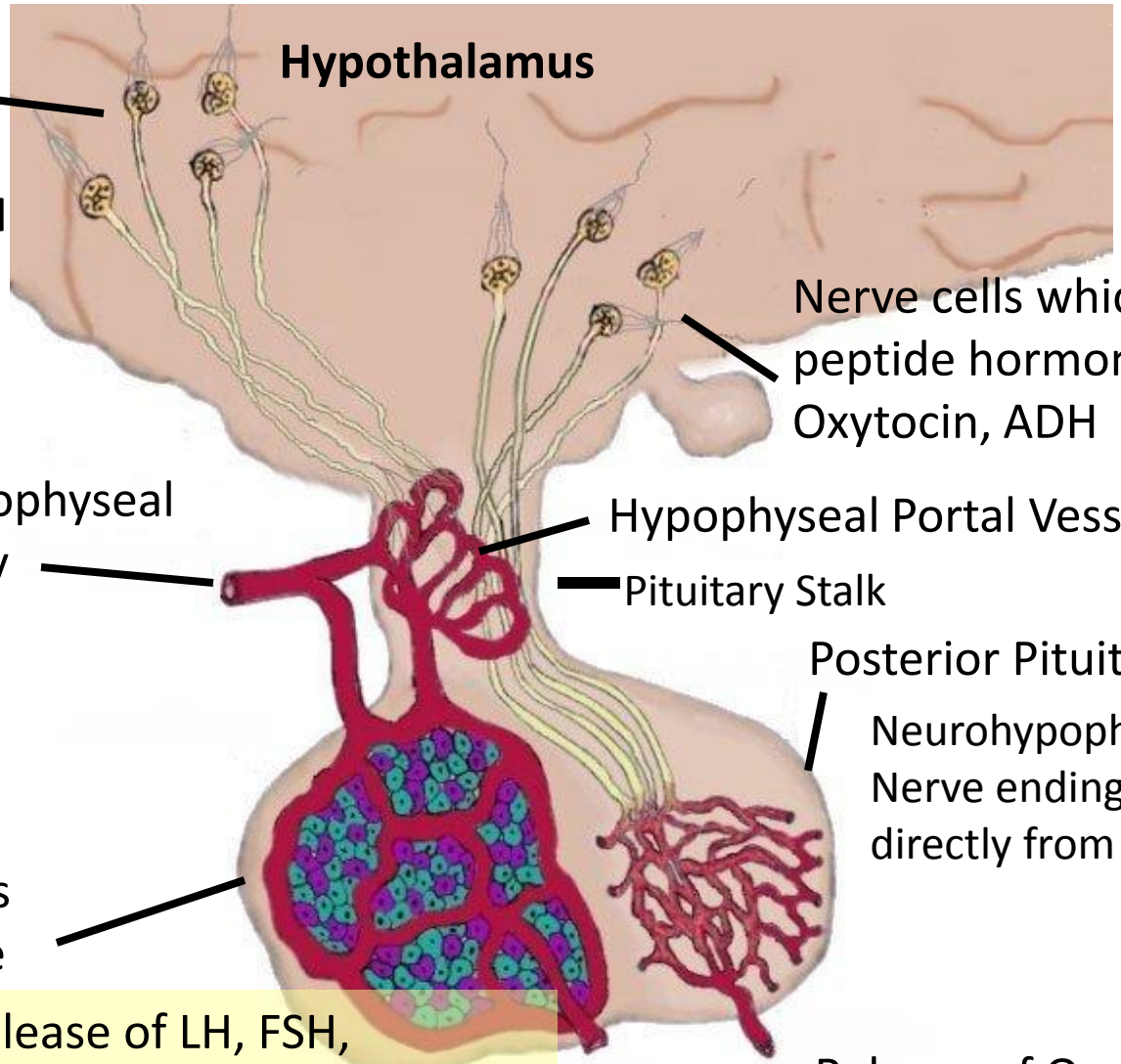
Diaphragma sellae

Pituitary

Spenoid Bone

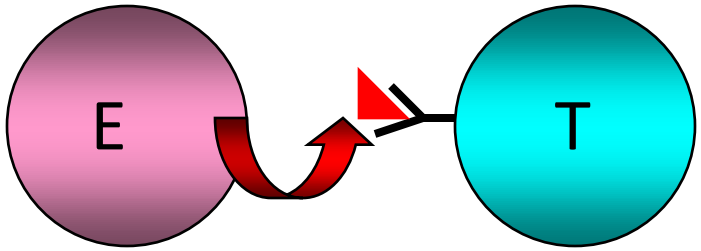
Control of Endocrine Gland Function

Hypothalamic-Pituitary Interrelationships

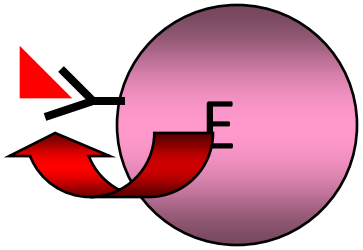


Other forms of endocrine action

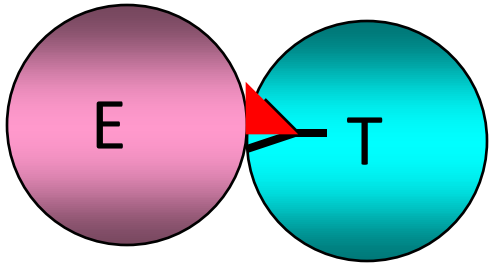
1) Paracrine - released from effector cell (E) interact with a different target cell (T1).



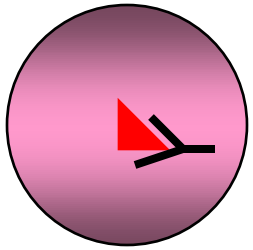
2) Autocrine - secreted by E interact with original E cell or similar cell types.



3) Juxtacrine -expressed on surface of E and interacts with target cell (T2) via direct cell-cell contact.



4) Intracrine - is not secreted by E and interacts with an intercellular receptor.



Ectocrine

- **Pheromones**: A chemical substance that is liberated by one animal and causes a relatively specific behavior modification in a recipient animal following its chemoreception
- Lee-Boot effect: Crowded female mice become anestrous when no males are present.
- Bruce effect: A newly mated female mouse will abort if placed with a strange male (not the previous mate).
- Dormitory effect: menstrual synchrony in all-females living groups

Structural Classes

- **Amines:**
  - Hormones derived from tyrosine and tryptophan.
    - NE, Epi, T_4.

- **<u>Peptides, Polypeptides and Proteins</u>**
  - **Polypeptides**
    - Chains of < 100 amino acids in length.
      - **ADH.**
    - **Ex: Adrenalcorticotropic Hormone (ACTH) – 39 amino acids**

  - **<u>Peptide</u>** - Few - Several amino acids
    - **Ex: Gonadotropin Releasing Hormone (GnRH) - 10 amino acids**
    - **Oxytocin - 8 amino acids**

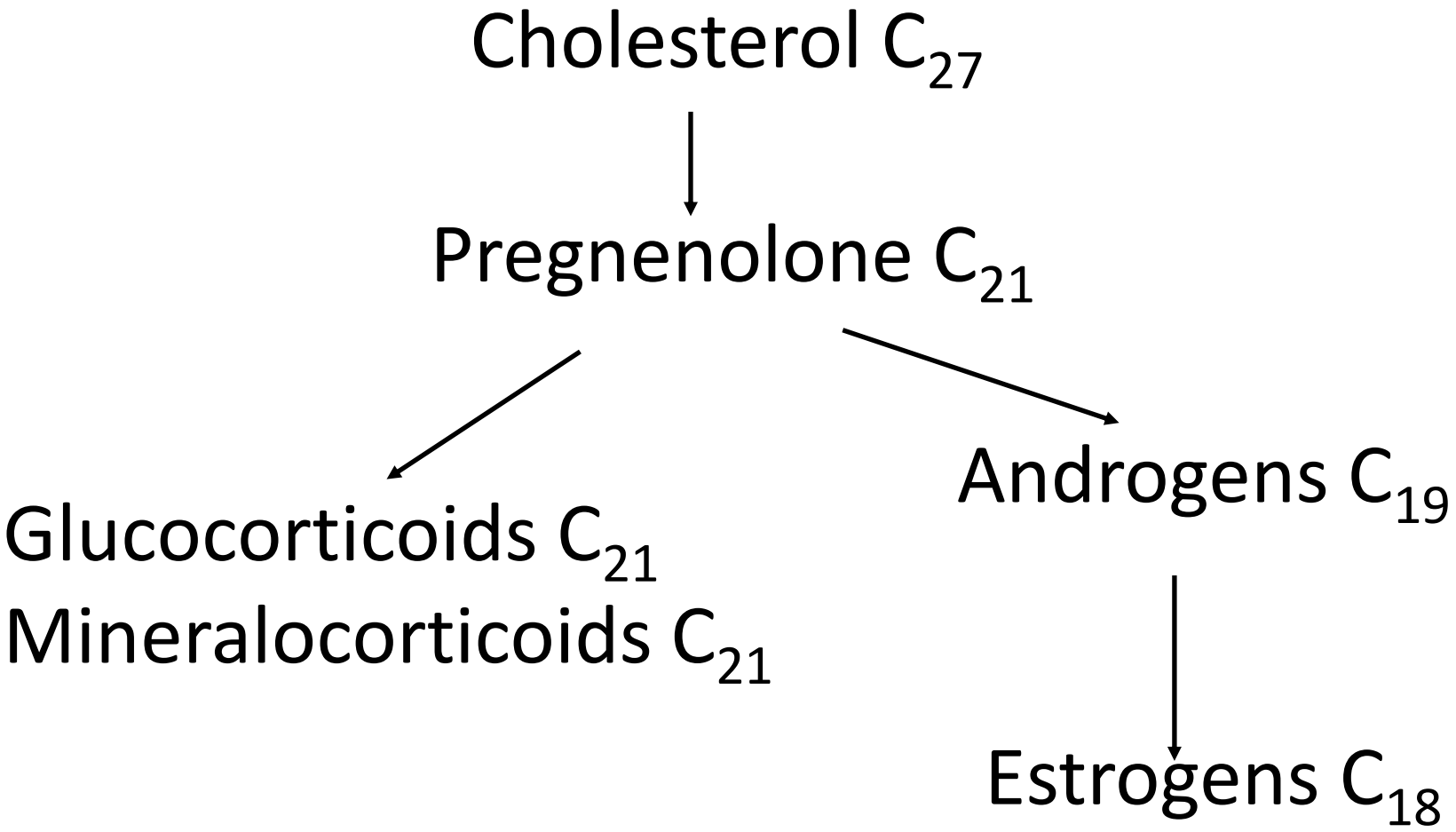
  - **Protein hormones:**
    - Polypeptide chains with > 100 amino acids.
      - **Growth hormone, Insulin, ACTH.**
      - Prolactin - 198 amino acids

Structural Classes

- **Glycoprotein** - Protein hormone with carbohydrate molecules

- Steroids
  - Lipids derived from cholesterol
  - – Are **lipophilic** (fat loving; can diffuse through plasma membrane) hormones.
    - Ex – testosterone, estradiol, progesteone, and cortisol

Mineralocorticoids, glucocorticoids and steroids are synthesized from cholesterol



Gland	Hormone	Chemical class	Principal functions
Hypothalamus	Gonadotropin-releasing hormone (GnRH)	Peptide	(1) FSH and LH release
	Prolactin-inhibiting factor (PIF)	Peptide	(1) Prolactin retention
	Prolactin-releasing factor (PRF)	Peptide	(1) Prolactin release
	Corticotropin-releasing hormone (CRH)	Peptide	(1) ACTH release

Anterior pituitary	Follicle-stimulating hormone (FSH)	Protein	(1) Follicle growth (2) Estrogen release (3) Spermatogenesis
	Luteinizing hormone (LH)	Protein	(1) Ovulation (2) Corpus luteum formation and function (3) Testosterone release
	Prolactin	Protein	(1) Milk synthesis
	Adrenocorticotropin (ACTH)	Polypeptide	(1) Release of glucocorticoid

Posterior pituitary	Oxytocin	Peptide	(1) Parturition (2) Milk ejection

Ovary	Estrogens (estradiol)	Steroid	(1) Mating behavior (2) Secondary sex characteristics (3) Maintenance of female duct system (4) Mammary growth
	Progestins ("progesterone)	Steroid	(1) Maintenance of pregnancy (2) Mammary growth
	Relaxin	Polypeptide	(1) Expansion of pelvis (2) Dilation of cervix
	Inhibin	Protein	(1) Prevention of release of FSH

Adrenal cortex	Glucocorticoids (Cortisol)	Steroid	(1)Parturition (2) Milk synthesis
Placenta	Human chorionic gonadotropin (hCG)	Protein	(1) LH-like
	Pregnant mare serum gonadotropin (P.MSG)	Protein	(l)FSH-like (2) Supplementary corpora lutea in mare
	Estrogens Progestins Relaxin	(See ovary)	
Uterus	Prostaglandin $F_2\ \alpha$ ($PGF_2\alpha$)	Lipid	(1) Regression of corpus luteum (2) Parturition