Endocrine System

Nervous system – fast responding but short acting system that modulates the activity of other organ systems by electrochemical signals
Endocrine System – slow responding but long acting system that modulates the activity of other organ systems by hormones

hormones are released non-selectively into blood by ductless glands
organ specificity results from the presence of receptors in target organs

unlike other organ systems, endocrine organs may have unrelated developmental origins
Organs typically included in the Endocrine system:
- Pineal Gland
- Hypophysis or Pituitary Gland
- Thyroid
- Parathyroid Glands
- Thymus
- Pancreas
- Suprarenal or Adrenal Glands
- Kidneys
- Gonads, Ovaries and Testes

Organs not typically included in the Endocrine system that legitimately could be:
- Hypothalamus
- Ultimobranchial Bodies
- Liver
Hypothalamus

part of Diencephalon, one of two major divisions of the Prosencephalon or “forebrain” (the other is the Thalamus) monitores blood chemistry and receives input from sensory systems regulates activity of the Hypophysis produces hormones:

1) stored and released by the Neurohypophysis, and
2) delivered to the Adenohypophysis via the Hypophyseal Portal System

Anteromedial hypothalamus – parasympathetic
Posterolateral hypothalamus – sympathetic
Diencephalon (in red)
Hypophysis
located in sella turcica of sphenoid

**Neurohypophysis** or **Posterior Pituitary** or **Pars Nervosa**
neural origin from diencephalon
stores and releases non-tropic hormones produced by the hypothalamus:
- **Oxytocin** – stimulates uterine contraction, mammary ejection (lactation)
- **Antidiuretic Hormone** or **Vasopressin** – raises blood pressure, stimulates water and electrolyte re-uptake by kidneys

(hypophysis continued)
**Hypophysis (continued)**

**Adenohypophysis or Anterior Pituitary or Pars Distalis**

a true gland derived from epithelium of the pharynx *(technically the stomodeum)*
regulated by hormones delivered by the **Hypophyseal Portal System** from the hypothalamus and neurohypophysis

secretes

- **tropins** – target a secondary endocrine organ; examples:
  - Adrenocorticotropic Hormone (**ACTH**) – target: cortex of adrenal glands
  - Thyrotropic or Thyroid Stimulating Hormone (**TSH**) – target: thyroid gland
  - Follicle Stimulating Hormone (**FSH**) – target: ovaries
  - Leutinizing Hormone (**LH**) – target: ovaries

- **non-tropins**
  - Growth Hormone (**GH**) or somatotropin (**STH**)
  - Prolactin
  - Melanocyte Stimulating Hormone (**MSH**)
Pineal Gland

a small posterior extension of diencephalon, the Epithalamus

secretes Melatonin
Thyroid Gland

bilobate, **isthmus** unites **right** and **left lobes**, **Thyroglossal Duct or pyramidal lobe** variably present located in thyroid region of anterior cervical triangle, anterolateral to cricoid cartilage and trachea

Prohormone produced by **Follicular Cells** converted to **Thyroxine in Colloid** by addition of **iodine**

**Ultimobranchial Body (Parafollicular cells)** embedded within thyroid gland and considered by many to be part of the thyroid secretes **calcitonin**
Parathyroid Glands
four in number embedded within thyroid gland
secretes **Parathyroid Hormone (PTH)**
Thymus

Organ of hematopoiesis of t-lymphocytes in childhood

Secretes **Thymosin**, stimulates maturation of t-lymphocytes

Consists of two lobes

Located posterior to manubrium in superior mediastinum in adulthood; largest in youth, extending from thyroid cartilage to mid-sternal body; replaced by fat and functionless after puberty
Pancreas

retroperitoneal on posterior abdominal wall
head and neck circumscribed by duodenum
body posterior to gaster
tail anterior to left kidney, ending at hilum of spleen

endocrine component: Islets or Islands of Langerhans

Endocrine functions
  Hormones affecting blood sugar balance
    Glucagon – elevates blood sugar
    Insulin – lowers blood sugar
    Diabetes melitus
    Diabetes insipidis – not related

(see digestive system lecture presentation)
Liver

located in right hypochondriac and upper right epigastric regions
see digestive lecture for details of relationships to other organs

secretes
  hormones, e.g.,
  
  **Insulin-like Growth Factor 1**
  **Thrombopoietin**

prohormone

**Angiotensinogen** (converted to Angiotensin I in blood by renin, which in turn is converted to Angiotensin II by Angiotensin-Converting Enzyme [ACE] in the lungs)

(see digestive system lecture presentation)
Kidneys

retroperitoneal on posterior abdominal wall
see urogenital lecture for details of relationships to other organs

endocrine component: Juxtaglomerular Apparatus (JGA) and Macula Densa
secrete Renin

(see urogenital system lecture presentation)
Suprarenal or Adrenal Glands
located superior to kidneys within perirenal fascia on posterior abdominal wall

internal architecture

1) Capsule
2) Cortex
   three layers, listed from superficial to deep:
   a) Zona Glomerulosa – secretes Mineralocorticoids, e.g., Aldosterone; electrolyte balance
   b) Zona Fasciculata – secretes Glucocorticoids, e.g., Cortisone; anti-inflammatory, cholesterol metabolism
   c) Zona Reticularis – secretes Gonadocorticoids, i.e., Estrogen and Testosterone

3) Medulla
   innervated by preganglionic neurons of sympathetic nervous system, of which it is developmentally and functionally part

secretes Epinephrin/Norephinephrine or Adrenaline/Noradrenaline
Gonads
develop on posterior abdominal wall
relative shortening of gubernaculum in males results in descent of testes and their blood and nerve supply through inguinal canal into scrotum

Ovaries
  Mature Ovarian Follicle secretes Estrogen
  Corpus Luteum secretes Progesterone

Testes
  Interstitial Leydig Cells secrete Testosterone

(see urogenital system lecture presentation)