Objectives

- To review the manner in which hormones work, using the figure on pg 4-32.
- To explore the hormones produced by:
  > the pituitary gland
  > the thyroid gland
  > the adrenal gland
- To understand the significance of regulation and feedback mechanisms.

Pituitary

Formerly known as "Master Gland"
 a.k.a. Hypophysis

Anterior Pituitary = adenohypophysis
- specialized cells make H's released from pituitary.
- Tropic hormones effect other endocrine glands (4)

Posterior Pituitary = neurohypophysis
 (H's produced in hypothalamus)

Hormones of the Pituitary

Anterior (all are peptide H's)
- Growth hormone GH
- Thyroid Stimulating TSH
- Adrenocorticotropic ACTH
- Follicle Stimulating FSH
- Lutenizing LH
- Prolactin
- Melanocyte stimulating MSH

Posterior (neurohormones)
- Antidiuretic ADH
- Oxytocin

Anterior Pituitary

I. Growth hormone
Action
Stimulates growth and protein synth.
Mobilizes energy reserves.

Acromegaly
Hyperscretion
acromegaly.org.uk

Hypothalamus \rightarrow Anterior Pituitary

V. Luteinizing (LH)
Stimulates ovulation, in males secretion of testosterone.

VI. Prolactin
Stimulates milk production in women.

VII. Melanocyte stimulating H
Stimulates melanocytes

Anterior Pituitary

II. Thyroid Stimulating H
Action
Stimulates thyroid to make thyroid H.

III. Adrenocorticotropic H
Stimulates adrenal cortex to make adrenal cortical H's

IV. Follicle Stimulating H
Stimulates growth of follicle in ovary and secretion of estrogen
Regulating the regulators

The Hypothalamus, located in the central region of the brain, and above the pituitary consists of neurosecretory cells that control the release of hormones from the pituitary.

> Neurosecretory = neurons (nerve cells) that secrete chemical signals to the pituitary:
  - Releasing hormones e.g. GHRF & TRF
  - Inhibiting hormones e.g. Prolactin & GH

Regulation by the Hypothalamus

Portal System
Intermingled capillary system for H transfer

Hypothalamus → Posterior Pituitary

Antidiuretic Hormone (ADH)
- Promotes reabsorption of water from kidneys.

Oxytocin
- Stimulates uterine contractions during labor.
- Causes milk ejection during lactation.
- In males causes sperm ejection.
- Found to be associated with trust.

The role of the thyroid gland

Regulates metabolism.
Stimulates the synthesis of enzymes involved with glucose breakdown.
Indirectly regulates growth rate.

Thyroxine (portion of TH)
- Increases metabolic rate, increases temperature, regulates growth, reactivity of many tissues.

Calcitonin
- Inhibits release of calcium from bones.
### Feedback Mechanisms

The synthesis and delivery of hormones is a precisely controlled process, which is regulated by feedback controls.

- **Positive Feedback** – enhances change
- **Negative Feedback** – counteracts

### Negative feedback example

The hypothalamus receives messages regarding the body’s temperature. This stimulates the anterior pituitary to release TSH. This in turn causes a release of hormones from the thyroid gland which will increase the metabolic rate. Generating heat. Warmer temperatures then inhibits the hypothalamic cells, and the feedback loop is suppressed.

### The effect of hormones on development in amphibians

Thyroxin produced by the thyroid gland controls the rate of metamorphosis.

Thyroxin also regulates seasonal molting and shedding.

### Parathyroid

**Location:**
- Posterior aspect of the thyroid
- Four glands (2 pr)

**Secretes – parathyroid hormone (PTH)**
- Stimulates release of Ca from the skeleton, the kidneys and intestine.
- Vitamin D needed to absorb from food.

<table>
<thead>
<tr>
<th>Parathyroid</th>
<th>Inhibits bone reabsorption. Stimulates calcium uptake.</th>
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<tbody>
<tr>
<td>I. Calcitonin (CT)</td>
<td>Raises Calcium levels in the fluids/serum.</td>
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<tr>
<td>II. Parathyroid (PTH)</td>
<td></td>
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Parathyroid hormone (PTH) control of blood calcium levels.

Osteoclasts degrade bone matrix and release Ca$^{2+}$ into blood. Parathyroid glands release parathyroid hormone (PTH).
The role of the adrenal glands

Controlled by the nervous system.
Involved with the sympathetic nervous system response of fight or flight.
Responds to stress.
Cortex region also involved with the control of glucose metabolism.

Adrenal Medulla

Epinephrine a.k.a. adrenaline & norepinephrine

Increases level of sugar and fatty acids in blood.
Increases metabolic rate.
Increases heart rate and contractions of the heart.
Constricts blood vessels

Adrenal Cortex

Aldosterone

Increases reabsorption of salt in kidneys

Testosterone

Causes masculinization of body features.

Types of Corticoids

I. Mineralocorticoids – Aldosterone
II. Glucocorticoids – Cortisol
III. Gonadocorticoids - Testosterone

Regulation of stress response

CRH – Corticotrophin-releasing hormone
A neurohormone
Secreted by the hypothalamus.

ACTH – adrenocorticotropic hormone
A peptide hormone
Secreted by ant. Pituitary
This hormone triggers the release of stress hormones.

Stress Hormones

Cortisol
Stress hormone
Released by adrenal glands
Acts on liver
Stimulates metabolism
Converts glycogen \rightarrow glucose
For more energy

* Negative feedback regulation