

## Hormones:

definition - a chemical signal released into body fluids. Generally this regulates or causes a specific action. Usually, only specific cells known as target cells will respond, but some hormones can affect many different systems:

A simple example:

Adrenal gland -> epinephrine -> raises blood sugar level, increases heart rate, generally increases metabolic activity.

[target cells include liver, heart, lungs.]

Endocrine glands - glands that secrete hormones. The human body has lots, only some of which will be covered here [Fig. 26.3, p. 520].

(Also, exocrine glands -> essentially hormones that are released outside body e.g., pheromones).

See table on p. 521 for a list of hormones in humans (not exhaustive).

## Hypothalamus/pituitary:

Pituitary - a small gland at base of brain. Composed of two parts [Fig., 26.4 A, B & C]:

### Anterior pituitary

- directly controlled by the hypothalamus (through a portal vein system).
- synthesizes and secretes hormones depending on whether or not a “releasing hormone” or “inhibiting hormone” is produced by the hypothalamus. All hormones made here have at least a “releasing hormone”.
- hormones produced here include:
  - GH - growth hormones.
  - Prolactin - stimulates mammary glands.
  - FSH/LH - affects testes or ovaries.
  - Thyroid stimulating hormone (TSH).
  - ACTH - stimulates adrenal cortex.
  - MSH - stimulates melanocytes (affects pigments - not in your text).
  - endorphins - regulates pain receptors in brain (dulls pain).
- keep this list in mind - some of these will come up again later.

### Posterior pituitary

- stores and releases two hormones that are manufactured by hypothalamus:
  - oxytocin - induces contractions of uterus (next lecture)
  - ADH - Anti Diuretic Hormone - discussed in our previous lecture.

Other endocrine glands/ functions, etc.:

Pineal gland - secretes melatonin, which regulates sleep cycles. Also used to “set” biological clock (jet-lag?).

Thymus gland - stimulates development of T-cells.

Thyroid hormones - Thyroid secretes thyroxine that is directly responsible for growth and metabolism (thyroxine requires iodine).

Hypothalamus --> A. Pituitary --> TSH (from above) --> stimulates thyroid.

(both TSH and thyroxine can slow down further release of TSH from hypothalamus, [Fig. 26.4D, p. 523])

Calcium homeostasis in blood [Fig. 26.6, p. 525]

Thyroid also releases calcitonin. Calcitonin lowers blood calcium levels.

Calcitonin --> stimulates Calcium deposits in bones, reduces calcium uptake by intestine and kidney.

Parathyroid - glands embedded in thyroid. Parathyroid releases PTH (parathyroid hormone). This raises blood calcium levels.

PTH --> causes bones to release calcium, increases calcium uptake by intestine and kidneys.

Pancreas - insulin/glucagon pathway:

- [Fig. 26.7 p. 526]

- excess sugar --> release of insulin --> liver absorbs glucose (converts glucose to glycogen), cells absorb glucose.

- insufficient sugar --> release of glucagon --> liver breaks down glycogen, releases this into blood stream.

- type I diabetes (insulin dependent) - immune system attacks cells of pancreas. Destroys ability to produce insulin.

- type II diabetes (non-insulin dependent) - due to deficiency in insulin production.

- the problem with diabetes:

- If glucose is not available, then fats are metabolized.

- This causes acid byproduct (ketones) which lowers blood pH to dangerous levels.

- Also, since sugar concentration in blood stays high, sugar is excreted by kidneys.

- This louses up water balance as water follows sugar. Result is lots of urination and resulting thirst.

#### Adrenal medulla and cortex [Fig. 26.9, p. 528]:

- adrenal medulla releases epinephrine (= adrenalin) and norepinephrine. This causes “flight or fight” response.

- adrenal medulla is directly controlled by the nervous system.

- adrenal cortex responds to endocrine signals, not nervous system signals (more responsive to long term stress):

- stress --> ACTH released by ant. pituitary --> causes adrenal cortex to release corticosteroids.

(Note: ACTH = Adrenocorticotropic hormone).

- the release of corticosteroids results in:

- retention of water and salt

- increased blood volume/pressure

- protein and fat converted to glucose, thus increased blood sugar.

- immune system suppression.

- corticosteroids inhibit ACTH production, thus serving as a negative feedback system.

- corticosteroids are broken down into several different classes, but we'll skip those details.

(cortisone was once indiscriminately used to fight inflammations, but has since been found to have serious immunological side-effects).

- sex hormones discussed in nauseating detail during reproduction lecture.