

The Hormones of Metabolism

There are three endocrine glands involved with regulating body metabolism.

- The anterior pituitary produces growth hormone.
- The thyroid gland helps regulate the rate at which glucose is oxidized
- The parathyroid gland regulates calcium and phosphate levels.

The Thyroid Gland

- The thyroid gland is located at the base of the neck, in front of the trachea or windpipe.
- When stimulated by TSH it releases the hormones thyroxine and triiodothyronine.
- Iodine is an important component of both these hormones and must be ingested for proper formation.
- These hormone increases sugar consumption and energy production especially in the heart, skeletal muscle, liver and kidney.
- People with higher thyroxine levels use up glucose and other nutrients more quickly so they tend not to gain weight.
- In more extreme cases it is called hyperthyroidism.
- If thyroxine levels are naturally low, people tend to gain weight more easily as it takes longer to use up the glucose in the blood so any excess is converted to fat.
- This is called hypothyroidism.
- The levels of the hormone are controlled by a negative feedback loop.
- Receptors in the hypothalamus recognize when thyroxine levels fall and secrete thyroid-releasing hormone which stimulates the pituitary to release thyroid-stimulating hormone. TSH then stimulates the thyroid to release more thyroxine.
- This gland also releases another hormone called calcitonin which is responsible for promoting the movement of calcium from the blood into bone tissue.
- This hormone is released when a calcium rich meal is digested.
- The majority of all calcium is stored in the skeletal bones of the body.
- This hormone works in concert with a hormone that is produced by the parathyroid gland.

The Parathyroid Gland

- These four small glands are embedded within the thyroid gland.
- These glands maintain homeostasis by responding directly to chemical changes in their surroundings.
- When calcium levels are low the glands release parathyroid hormone (PTH) which raises calcium levels.
- It does this by acting on the kidney, the intestines and the bones.
- The hormone induces the kidney to retain calcium while promoting calcium release from the bones. Bone cells break down and the calcium and phosphate separate. The calcium enters the blood and the phosphate is excreted in the urine. The intestine also adds to calcium level by prompting better absorption of calcium from digested foods. Once calcium levels increase, PTH is no longer released.

- Due to the actions of calcitonin from the thyroid gland and PTH from the parathyroid gland, calcium levels in the blood are maintained. These hormones are called antagonistic hormones because they have opposite effects on the same substance. The body uses many of these antagonistic systems to maintain balance.

The Hormones that Affect Metabolism

| Gland | Hormone | Effect on Metabolism |
|--------------------|--------------------------------|--|
| Thyroid | Thyroxine and triiodothyronine | Regulates the rate at which glucose is oxidized |
| Thyroid | Calcitonin | Lowers calcium levels in the blood |
| Parathyroid | Parathyroid hormone (PTH) | Raises calcium levels in the blood |
| Anterior pituitary | Growth hormone | Promotes protein synthesis by increasing uptake of amino acids by cells Causes a switch in cellular fuels from glucose to fatty acids |