15.8C: Action of Thyroid Hormones

The primary function of the thyroid is to produce the hormones triiodothyronine (T3), thyroxine (T4), and calcitonin.

Learning Objectives

• List the actions of thyroid hormones

Key Points

• T4 is converted to T3 by peripheral organs such as the liver, kidney, and spleen.
• Triiodothyronine (T3) is several times more powerful than T4, which is largely a pro-hormone.
• The regulation of actin polymerization by T4 is critical to cell migration in neurons and glial cells and is important for brain development.
• Thyroid hormones play an important role in regulating metabolic rate and body temperature.

Key Terms

• thyroxine: A hormone (an iodine derivative of tyrosine) produced by the thyroid gland that regulates cell metabolism and growth.

Triiodothyronine (T3) and thyroxine (T4) are enzymes produced by the thyroid gland. T4 is thought to be a pro-hormone to the more metabolically active T3. T4 is converted to T3 in tissues as required by deiodinase enzymes.

Calcitonin is another hormone released by the thyroid gland that is responsible for modulating blood calcium levels in
conjunction with parathyroid hormone, which is released from the parathyroid.

**Effect of Thyroid Hormones on Metabolism**

The main activity of the thyroid hormones T3 and T4 is to boost the basal metabolic rates of proteins, fats, and carbohydrates as well as vitamins.

![Thyroid system](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(Boundless)/15%3A_…)

**Thyroid system**: An overview of the thyroid system.

**Effect of Thyroid Hormones on Body Temperature**

Thyroid hormones affect the dilation of blood vessels, which in turn affects the rate at which heat can escape the body. The more dilated blood vessels are, the faster heat can escape.

A person who suffers from hyperthyroidism (an over-active thyroid) will experience a fever; conversely, a person who suffers from hypothyroidism (a less active thyroid) will experience a decrease in body temperature.

**Action of Thyroid Hormones on the Developing Fetus**

The cells of the developing brain are a major target for T3 and T4. Thyroid hormones play a particularly crucial role in brain maturation during fetal development by regulating actin polymerization during neuronal development.
Action of Thyroid Hormones in Blood

In the blood, T4 and T3 are partially bound to thyroxine-binding globulin (TBG), transthyretin, and albumin. Only a very small fraction of the circulating hormone is free—T4 0.03% and T3 0.3%. Only the free fraction has hormonal activity.

As with the steroid hormones, thyroid hormones are lipophilic and can cross the cell membrane and bind to intracellular receptors, which act alone as transcription factors or in association with other factors to modulate DNA transcription.

Calcitonin Activity

Calcitonin acts to lower blood calcium levels in three ways:

1. Inhibiting the osteoclast-mediated breakdown of bones.
2. Stimulating osteoblastic activity to produce new bone tissue.
3. Inhibiting re-absorption of calcium in the kidneys.