

9.3.2

Regulation of Thyroid Hormone Secretion

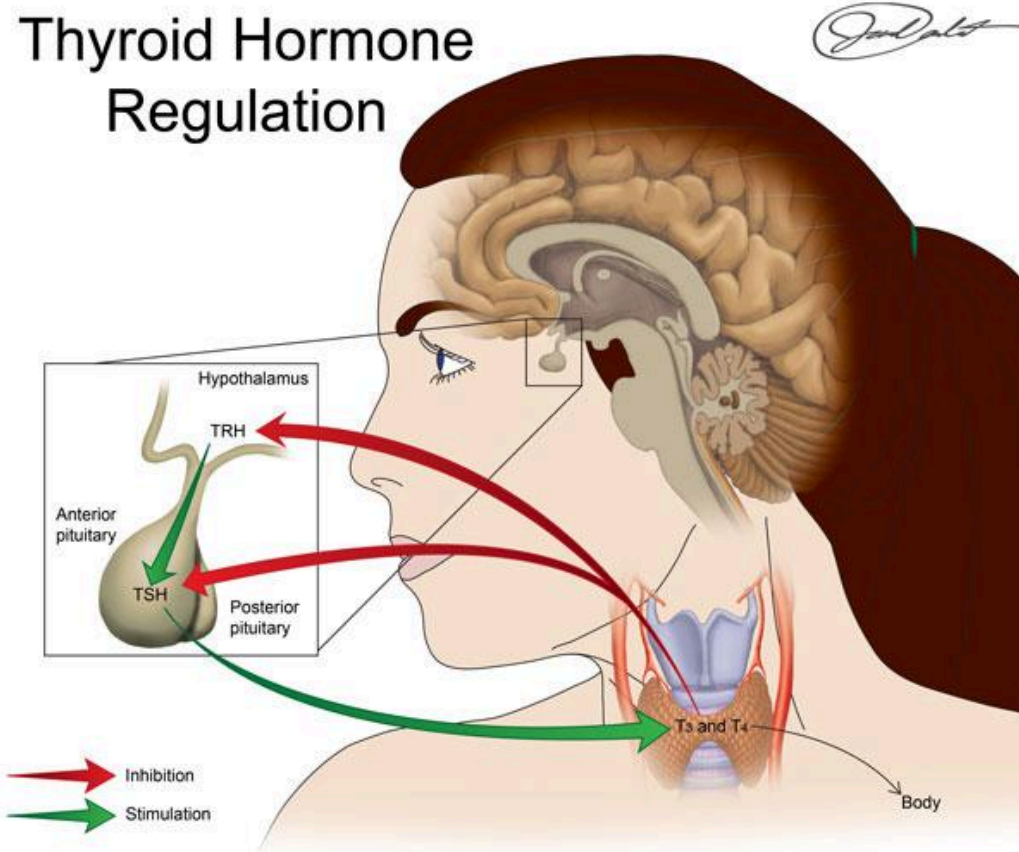
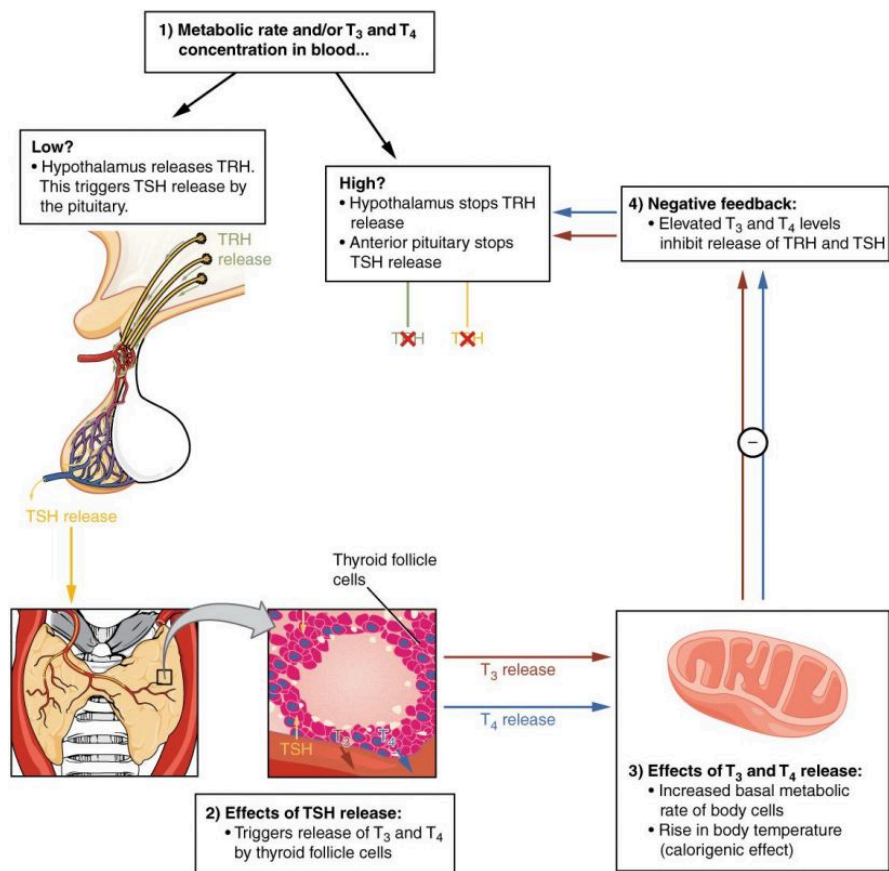


Image by BYU-Idaho Winter 2015

Regulation of thyroid hormone secretion begins at the hypothalamus (see the image above). Recall that the hypothalamus secretes the hormone **thyrotropin-releasing hormone** (TRH) into the hypothalamo hypophyseal portal system. TRH stimulates cells in the anterior pituitary to secrete the hormone **thyroid-stimulating hormone** (TSH). TSH then stimulates the thyroid gland to secrete thyroid hormones, Thyroxine (T₄) and T₃. Proper levels of thyroid hormones in the blood are regulated by a classic negative feedback system. If thyroxine and T₃ levels are high, they feed back on the hypothalamus and the pituitary to decrease TSH release. At the level of the hypothalamus, the thyroid hormones inhibit TRH production. In the anterior pituitary, they reduce the number of TRH receptors and inhibit TSH synthesis. The overall effect is to reduce TSH levels, which in turn lowers thyroid hormone synthesis and release. If thyroid hormone levels are low the inhibition is removed and more TSH is secreted to stimulate production and release of more thyroid hormones. Since the thyroid hormones have long half-lives, their concentrations in the blood remain relatively constant and do not tend to fluctuate.



Negative Feedback Loop regulating Thyroid Hormone Levels.

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Another level of control of thyroid hormone activity occurs at the level of the target tissues. T_3 is much more biologically active than thyroxine. At the target tissue thyroxine can be deiodinated (one of the iodine is removed) to produce T_3 . The enzyme that removes the iodine is **deiodinase**. By increasing or decreasing the activity of deiodinase thyroid hormone activity can be modulated.

Another factor that can impact thyroid hormone secretion is caloric intake. If caloric intake is greatly elevated (particularly increased carbohydrate consumption), T_3 levels go up and metabolism is increased. On the other hand, if caloric intake is drastically reduced as would happen during starvation or a strict diet, T_3 levels decrease and metabolism goes down. These mechanisms are thought to be regulated at the level of the target tissues rather than in the thyroid gland, hence they are mediated by changes in the activity of the deiodinase enzyme.



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