

TSH feedback loop

Thyroid

If the thyroid gland is not able to produce thyroid hormone, the body will keep sending it signals to make the hormone. That signal is TSH, and the commonest cause of a high TSH is hypothyroidism. The thyroid may not make thyroid hormone if there is not enough iodine in the diet (cretinism) or if the thyroid comes under immune attack (Hashimoto's disease), is surgically removed, or becomes fibrosed (Riedel's thyroiditis) or inflamed with a viral infection (de Quervain's thyroiditis). There is a small risk of thyroid cancer with higher levels of TSH.

TSH (thyroid stimulating hormone) is part of a feedback loop controlling levels of thyroid hormone. TSH levels are high when parts of this feedback loop do not function properly. The commonest cause is a problem in the thyroid resulting in hypothyroidism, treated with thyroid hormone. A tumor in the pituitary gland or the hypothalamus can also cause high TSH levels and hyperthyroidism. A thyroid scan and thyroid tests identify the cause.

Thyroid stimulating hormone (TSH) is a protein hormone released from the pituitary gland in the brain that stimulates the thyroid to produce thyroid hormone, which regulates body metabolism. TSH is released from the pituitary in response to the release of TRH (thyroid releasing hormone) from the hypothalamus (also in the brain). In a negative feedback loop, thyroid hormone sends a regulatory signal to the hypothalamus to decrease TRH levels.

Pituitary and Hypothalamus

The pituitary and hypothalamus are part of the brain. A rare pituitary tumor (pituitary adenoma) can create too much TSH. Even less

commonly, a tumor forms in the hypothalamus, while releasing TRH, in turn causes TSH levels to rise.

Hyperthyroidism and Hypothyroidism

Two opposite conditions can occur with high TSH levels: the body either produces too much thyroid hormone (hyperthyroidism) or not enough (hypothyroidism). Hyperthyroidism is a condition in which the metabolism speeds up. A person can lose weight, have a fast heartbeat, sweat excessively, be intolerant of heat, become anxious and have difficulty concentrating, and have osteoporosis and diarrhea. Hypothyroidism is the opposite condition, a slower metabolism with weight gain, slow heartbeat, cold skin, cold intolerance, stunted growth and constipation.

Diagnosing Hypothyroidism

The problem can be identified if the levels of thyroid hormone and iodine are measured. Low thyroid hormone levels suggest the thyroid is not functioning normally. Iodine levels can also be checked. A thyroid scan measures whether the thyroid is functioning. Fortunately, thyroid hormone can be replaced, correcting the TSH levels.

Diagnosing Hyperthyroidism

If there is a tumor in the pituitary (rare), levels of TRH will be low because high levels of thyroid hormone will tell the hypothalamus to stop producing TRH. If there is a tumor in the hypothalamus (very rare), then levels of both TRH and thyroid hormone will be high. Practically however, a combination of a CT scan or MRI and a subtype of thyroid hormone called T3 will identify these rare tumors, because TRH cannot be measured.