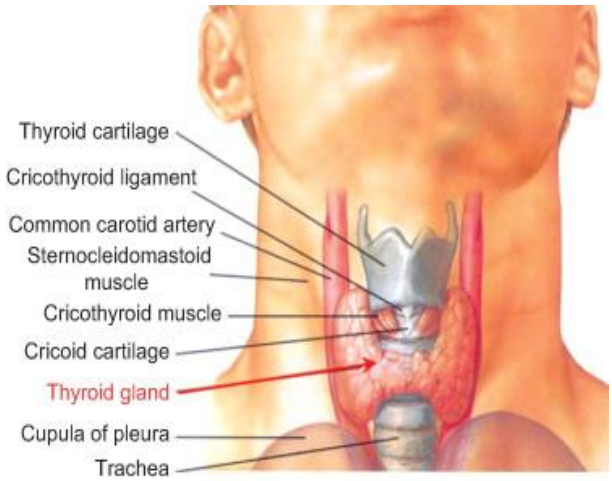
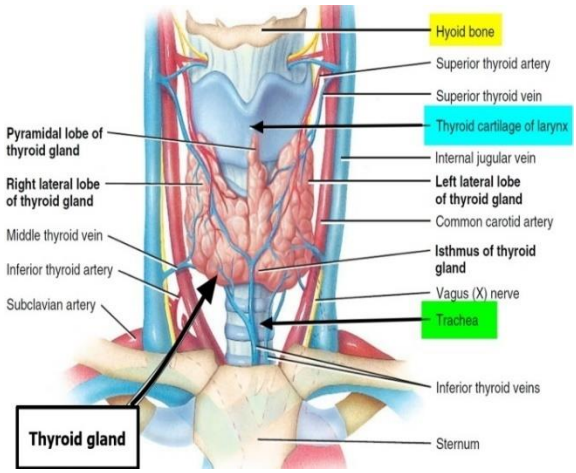
THYROID GLANDS

The **thyroid gland** is an endocrine organ located in the neck that participates in a myriad of systemic processes. The effects of the hormones it produces can be seen throughout all systems in the body.

Thyroid hormones are able to diffuse freely across cell membranes. They can then enter the nucleus of the cell and bind to thyroid hormone receptors (which exist as a heterodimer that is attached to another receptor). The thyroid receptor hormone then activates a transcription pathway specific to the cell line it is located in. Consequently, the mRNA is translated and the synthesized protein will have its desired effect within that system.





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ANATOMY

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The **anterior triangles** are formed in the midline by an imaginary line called the median line of the neck that transects the symphysis menti (mandibular symphysis), laterally by the medial border

of sternocleidomastoid and superiorly by the inferior border of the **mandible** . The thyroid gland occupies the inferior part of both anterior triangles.

the gland is related with larynx and trachea and is fixed to the cricoid cartilage, along with the first two tracheal rings, by the suspensory ligament of Berry. The **cricothyroid** muscles and the **inferior constrictors** of the pharynx are the medial muscular relations. The external laryngeal nerve passes by the gland along this border as well. Both the **recurrent laryngeal nerve** and the trachea are posteroinferiorly related to the medial border of the thyroid gland.

DISORDERS OF THYROID GLANDS

Hyperthyroidism

Hyperthyroidism can lead to Graves' disease, which has many symptoms, including sweating, arrhythmia (irregular heartbeat), weight loss, protruding eyes and nervousness.

Hypothyroidism

Symptoms of hypothyroidism can include tiredness, weight gain, depression, abnormal bone development and stunted growth. The most common cause is autoimmune: the production of antibodies that attack the thyroid gland.

Hashimoto's Thyroiditis

Hashimoto's thyroiditis, an autoimmune disorder, is an inflammation of the thyroid gland. It can cause a goiter (swelling in the neck due to an enlarged thyroid gland) and other symptoms.

Thyroid Tumors

Thyroid nodules and adenomas, small, noncancerous growths, start in the cell layer that lines the inner surface of the thyroid gland. The adenoma itself may secrete thyroid hormone and may cause hyperthyroidism. Thyroid adenoma treatment may include surgery to remove the overactive nodule.

Thyroid Cancer

Thyroid cancer occurs more often in people who have undergone radiation to the head, neck or chest. However, it may also occur in those without any known risk factors. There are four main types of thyroid cancer: papillary thyroid cancer, follicular thyroid cancer, anaplastic thyroid cancer and medullary thyroid cancer. Most thyroid cancer can be treated successfully.

Thyroid Disorders in Women

Women's thyroid disease can affect their hormone balance and cause problems in puberty, menstruation, fertility, pregnancy and the postpartum period.

Thyroid Hormone Replacement Therapy

Thyroid hormone comes in pill form and is often used to treat an underactive thyroid that is secreting little or no thyroid hormones. The most commonly prescribed thyroid hormone replacement is synthetic thyroxine (T4).

Hypothyroidism and Pregnancy

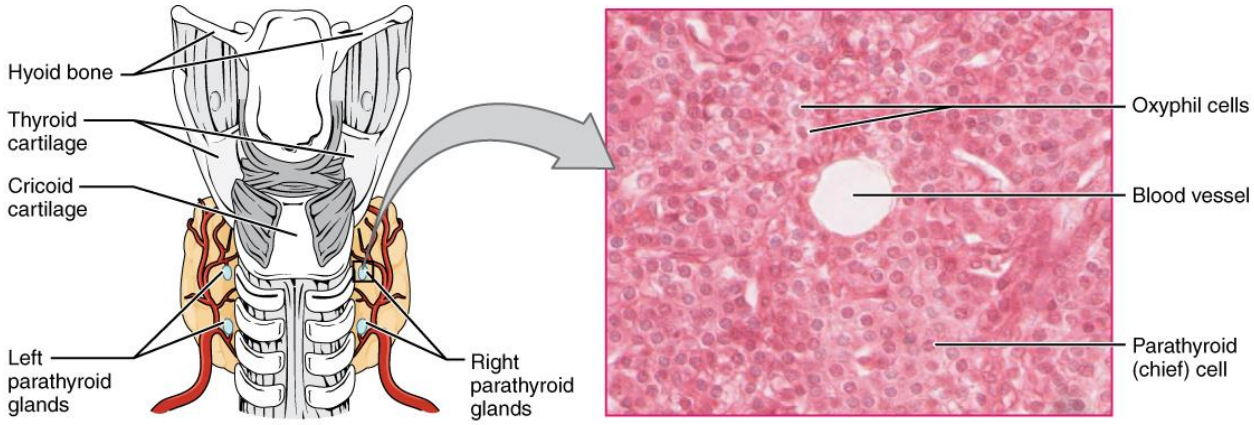
Thyroid hormones pass from mother to fetus, and adequate amounts are important for normal growth and brain development. Hypothyroidism during pregnancy can be treated safely with thyroid hormone medications.

Postpartum Thyroiditis

Postpartum thyroiditis is inflammation of the thyroid gland that occurs after giving birth and can cause hyper- or hypothyroidism. It is treatable with medication, and in about 80% of cases resolves after 12 to 18 months.

PARATHYROID GLAND

Parathyroid glands are tiny, round structures usually found embedded in the posterior surface of the thyroid gland A thick connective tissue capsule separates the glands from the thyroid tissue. Most people have four parathyroid glands, but occasionally there are more in tissues of the neck or chest. The function of one type of parathyroid cell, the oxyphil cells, is not clear. The primary functional cells of the parathyroid glands are the chief cells. These epithelial cells produce and secrete the **parathyroid hormone (PTH)**, the major hormone involved in the regulation of blood calcium levels.



a) Thyroid gland, posterior view

b) Micrograph of parathyroid tissue

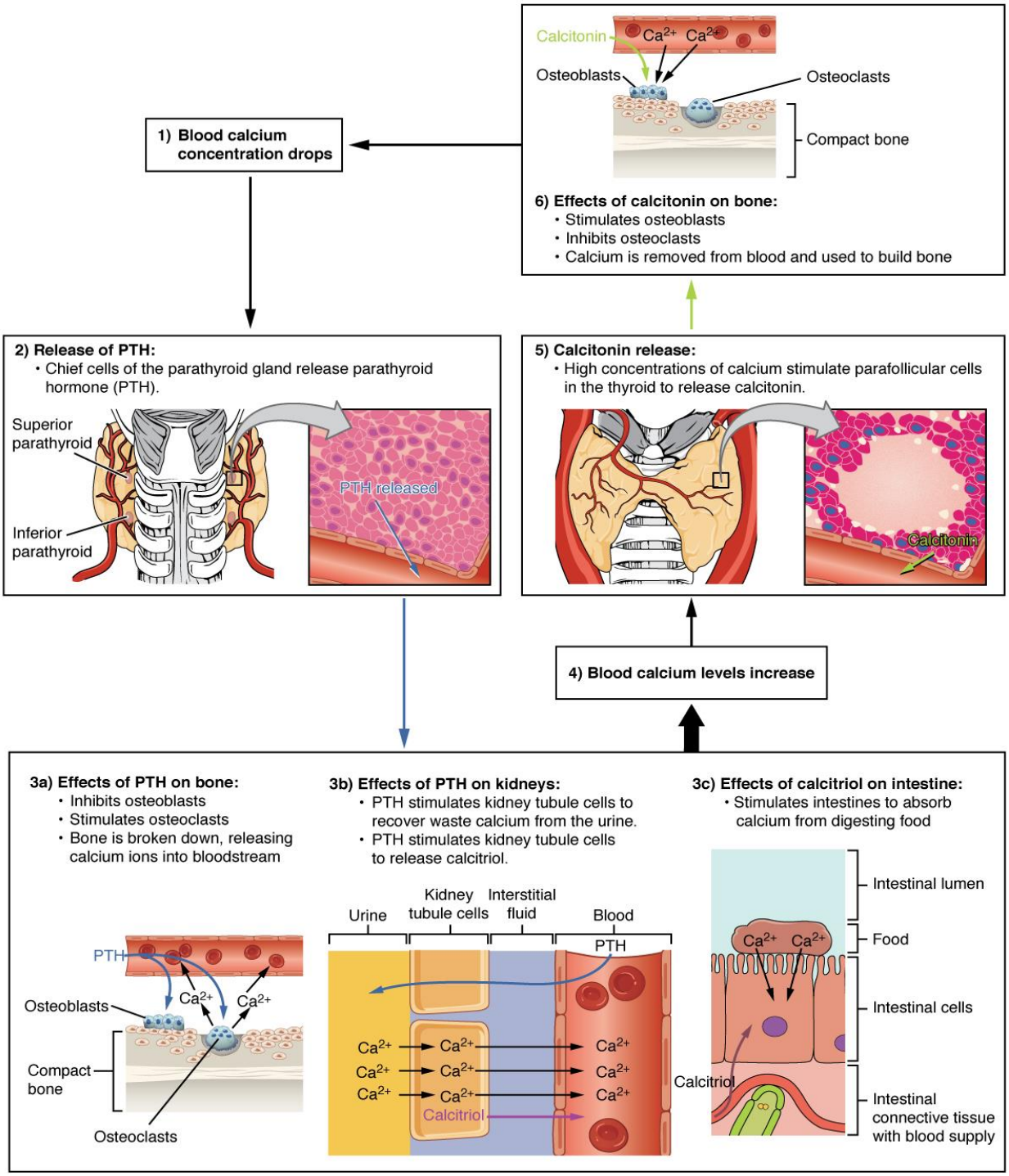
The parathyroid glands produce and secrete PTH, a peptide hormone, in response to low blood calcium levels. PTH secretion causes the release of calcium from the bones by stimulating osteoclasts, which secrete enzymes that degrade bone and release calcium into the interstitial fluid. PTH also inhibits osteoblasts, the cells involved in bone deposition, thereby sparing blood calcium. PTH causes increased reabsorption of calcium (and magnesium) in the kidney tubules from the urine filtrate. In addition, PTH initiates the production of the steroid hormone calcitriol (also known as 1,25-dihydroxyvitamin D), which is the active form of vitamin D_3, in the kidneys. Calcitriol then stimulates increased absorption of dietary calcium

by the intestines. A negative feedback loop regulates the levels of PTH, with rising blood calcium levels inhibiting further release of PTH.

Abnormally high activity of the parathyroid gland can cause **hyperparathyroidism**, a disorder caused by an overproduction of PTH that results in excessive calcium reabsorption from bone. Hyperparathyroidism can significantly decrease bone density, leading to spontaneous fractures or deformities. As blood calcium levels rise, cell membrane permeability to sodium is decreased, and the responsiveness of the nervous system is reduced. At the same time, calcium deposits may collect in the body's tissues and organs, impairing their functioning.

In contrast, abnormally low blood calcium levels may be caused by parathyroid hormone deficiency, called **hypoparathyroidism**, which may develop following injury or surgery involving the thyroid gland. Low blood calcium increases membrane permeability to sodium, resulting in muscle twitching, cramping, spasms, or convulsions. Severe deficits can paralyze muscles, including those involved in breathing, and can be fatal.

When blood calcium levels are high, calcitonin is produced and secreted by the parafollicular cells of the thyroid gland. As discussed earlier, calcitonin



inhibits the activity of osteoclasts, reduces the absorption of dietary calcium in the intestine, and signals the kidneys to reabsorb less calcium, resulting in larger amounts of calcium excreted in the urine.