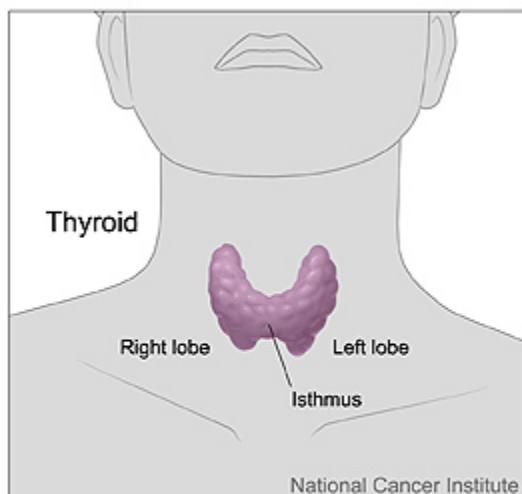


Thyroid Diseases

What is the thyroid?

The thyroid is a small, butterfly-shaped gland located just below the Adam's apple. This gland plays a very important role in controlling the body's **metabolism**, that is, the rate at which the body uses energy. It does this by producing thyroid **hormones** (primarily thyroxine, or T4, and triiodothyronine, or T3), chemicals that travel through the blood to every part of the body. These thyroid hormones tell the cells in the body how fast to use energy and create proteins. The thyroid gland also makes calcitonin, a hormone that helps to regulate calcium levels in the blood by inhibiting the breakdown (reabsorption) of bone and increasing calcium excretion from the kidneys.



Location of the thyroid
Source: National Cancer Institute
Artist: Don Bliss

The body has an elaborate **feedback system** to control the amount of T4 and T3 in the blood. When blood levels decrease, the **hypothalamus** releases thyrotropin-releasing hormone, which in turn causes the **pituitary gland** to release thyroid-stimulating hormone (TSH). TSH stimulates the thyroid gland to produce and secrete thyroid hormones. When there is sufficient thyroid hormone in the blood, the amount of TSH decreases to maintain constant amounts of thyroid hormones, T4 and T3.

Inside the thyroid, most of the T4 is stored bound to a protein called thyroglobulin. When the need arises, the thyroid gland creates more T4 and/or releases some of what is stored. In the bloodstream, most T4 is bound to a protein called thyroxine-binding globulin (TBG) and is relatively inactive. T4 is converted to T3 by the liver and in many other tissues. T3 is primarily responsible for controlling the rate of body functions.

What are thyroid diseases?

Thyroid diseases are primarily conditions that affect the amount of thyroid hormones being produced. It is estimated that 20 million Americans have some form of thyroid disease, and approximately 60% of those with thyroid disease do not know it. Women are more likely than men to have thyroid problems, with 1 in 8 developing a thyroid disorder during her life. The following is a list of the more common thyroid disorders.

- **Hypothyroidism:** too little thyroid hormone; slowing of body functions; symptoms include weight gain, dry skin, constipation, cold intolerance, puffy skin, hair loss, fatigue, and menstrual irregularity in women. Severe untreated hypothyroidism, called myxedema, can lead to heart failure, seizures, and coma. In children, hypothyroidism can stunt growth and delay sexual development. In infants, it can cause mental retardation. For this reason, hypothyroidism testing is performed in the United States as part of **newborn blood screening programs** since early detection and treatment can minimize long-term damage.
- **Hyperthyroidism:** too much thyroid hormone; sometimes called "overactive thyroid;" acceleration of body functions; symptoms include increased heart rate, anxiety, weight loss, difficulty sleeping, tremors in the hands, weakness, and sometimes diarrhea. There may be puffiness around the eyes, dryness, irritation, and, in some cases, bulging of the eyes. The affected person may experience light sensitivity and visual disturbances. Because the eyes may not move normally, the person may appear to be staring.
- **Graves Disease:** the most common cause of hyperthyroidism; it is a **chronic autoimmune disorder** in which the affected person's immune system produces **antibodies** that attack the thyroid, causing inflammation, damage, and the production of excessive amounts of thyroid hormone.
- **Hashimoto Thyroiditis:** the most common cause of hypothyroidism in the United States; like Graves disease, it is a chronic autoimmune condition related to the production of antibodies that target the thyroid and cause inflammation and damage. With Hashimoto thyroiditis, however, the body makes decreased amounts of thyroid hormone.
- **Thyroiditis:** an inflammation of the thyroid gland; it may be associated with either hypo- or hyperthyroidism. It may be painful, feeling like a sore throat, or painless. Thyroiditis may be due to autoimmune activity, an infection, exposure to a chemical that is toxic to the thyroid, or an unknown cause. Depending on the cause, it can be **acute** but transient or chronic.
- **Thyroid Nodules:** a small lump on the thyroid gland that may be solid or a fluid-filled **cyst**; these nodules are common, and the overwhelming majority of them are harmless. Occasionally, however, thyroid nodules can be cancerous and need to be treated.
- **Thyroid Cancer:** Thyroid cancer is fairly uncommon, with about 37,000 people diagnosed with it each year in the U.S. There are four main types of thyroid cancers: papillary, follicular, anaplastic, and medullary cancer. About 80% of thyroid cancer cases are papillary. This type affects more women than men and is more common in younger people. About 15% of thyroid cancers are follicular, a more aggressive type of cancer that tends to occur in older women. Anaplastic cancer, also found in older women, accounts for about 2% of thyroid cancers and tends to be both aggressive and difficult to treat. Medullary thyroid cancer

(MTC) produces calcitonin and may be found alone or linked with other endocrine cancers in a syndrome called multiple endocrine neoplasia syndrome. MTC, which accounts for 3% of thyroid cancers, can also be difficult to treat if it spreads beyond the thyroid.

- **Goiters:** a visible enlargement of the thyroid gland. In the past, this condition was relatively common and was due to a lack of iodine in the diet. Iodine is a necessary component of thyroid hormone production. In the United States, where iodine is now routinely added to table salt (iodized) and used to clean milking cows' udders, the incidence of dietary-related goiters has declined significantly. In other parts of the world, however, iodine-related goiters are still common and represent the most common cause of hypothyroidism in some countries. Any of the diseases listed above can also cause goiters. Goiters may compress vital structures of the neck, including the trachea and esophagus. This compression can make it difficult to breathe and swallow.

Laboratory Tests

The first test your doctor will usually order to detect thyroid dysfunction is a **TSH test**. If your TSH level is abnormal, the doctor will usually order a **total T4 or free T4 test** to confirm the diagnosis. A **total T3 or free T3 test** may be ordered as well.

- TSH – to test for hypothyroidism, hyperthyroidism, screen newborns for hypothyroidism, and monitor thyroid replacement therapy
- T4 or free T4 – to test for hypothyroidism and hyperthyroidism and to screen newborns for hypothyroidism
- T3 or free T3 – to test for hyperthyroidism

Additional tests that may be performed include:

- **Thyroid antibodies** - to help differentiate different types of thyroiditis and identify autoimmune thyroid conditions
- **Calcitonin** - to help detect the presence of excessive calcitonin production, which can occur with **C-cell hyperplasia** and **medullary thyroid cancer**

Screening

Screening for thyroid disease is controversial, and there is no consensus in the medical community as to who would benefit from screening and at what age to begin. In 2004, the U.S. Preventive Services Task Force found insufficient evidence to recommend for or against routine screening for thyroid disease in adults. However, the American Thyroid Association currently recommends that everyone over 35 years of age be screened with a TSH test every 5 years, and the American Association of Clinical Endocrinologists recommends that all women be tested for hypothyroidism by 50 years of age (sooner if they have a family history of thyroid disease) as well as those who are or planning to become pregnant in order to detect thyroid problems.

Non-Laboratory Tests

- Thyroid Scans – a test that uses radioactive iodine or technetium to look for thyroid gland abnormalities and to evaluate thyroid function in different areas of the thyroid
- Ultrasound – an imaging scan that allows doctors to determine whether a nodule is solid or fluid-filled and can help measure the size of the thyroid gland
- Biopsies – often a fine-needle biopsy, a procedure that involves inserting a needle into the thyroid and removing a small amount of tissue and/or fluid from a nodule or other area that the doctor wants to examine; an ultrasound is used to guide the needle into the correct position.

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