Know The Thyroid

The thyroid gland is a small, butterfly-shaped gland located in the base of the neck just below the Adam's apple. Although relatively small, the thyroid gland plays a huge role in our body, influencing the function of many of the body's most important organs, including the heart, brain, liver, kidneys and skin. Ensuring that the thyroid gland is healthy and functioning properly is vitally important to the body's overall well-being.

How Your Thyroid Works

Think of your thyroid as a car engine that sets the pace at which your body operates. An engine produces the required amount of energy for a car to move at a certain speed. In the same way, your thyroid gland manufactures enough thyroid hormone to prompt your cells to perform a function at a certain rate.

Just as a car can't produce energy without gas, your thyroid needs fuel to produce thyroid hormone. This fuel is iodine. Iodine comes from your diet and is found in iodized table salt, seafood, bread and milk. Your thyroid extracts this necessary ingredient from your bloodstream and uses it to make two kinds of thyroid hormone: thyroxine, also called T4 because it contains four iodine atoms, and triiodothyronine, or T3, which contains three iodine atoms. T3 is made from T4 when one atom is removed, a conversion that occurs mostly outside the thyroid in organs and tissues where T3 is used the most, such as the liver, the kidneys and the brain.

Once T4 is produced, it is stored within the thyroid's vast number of microscopic follicles. Some T3 is also produced and stored in the thyroid. When your body needs thyroid hormone, it is secreted into your bloodstream in quantities set to meet the metabolic needs of your cells. The hormone easily slips into the cells in need and attaches to special receptors located in the cells' nuclei.

Your car engine produces energy, but you tell it how fast to go by stepping on the accelerator. The thyroid also needs some direction; it gets this from your pituitary gland, which is located at the base of your brain. No larger than a pea, the pituitary gland is sometimes known as the "master gland" because it controls the functions of the thyroid and the other glands that make up the endocrine system. Your pituitary gland sends messages to your thyroid gland, telling it how much thyroid hormone to make. These messages come in the form of thyroid-stimulating hormone (TSH).

TSH levels in your bloodstream rise or fall depending on whether enough thyroid hormone is produced to meet your body's needs. Higher levels of TSH prompt the thyroid to produce more thyroid hormone. Conversely, low TSH levels signal the thyroid to slow down production.

The pituitary gland gets its information in several ways. It is able to read and respond directly to the amounts of T4 circulating in the blood, but it also responds to the hypothalamus, which is a section of the brain that releases its own hormone, thyrotropin-releasing hormone (TRH). TRH stimulates TSH

production in the pituitary gland. This network of communication between the hypothalamus, the pituitary gland, and the thyroid gland is referred to as the hypothalamic-pituitary-thyroid axis (HPT axis).

When Things Go Wrong

The HPT axis is a highly efficient network of communication. Normally, the thyroid doles out just the right amount of hormone to keep your body running smoothly. TSH levels remain fairly constant, yet they respond to the slightest changes in T4 levels and vice versa. But even the best networks are subject to interference.

When outside influences such as disease, damage to the thyroid or certain medicines break down communication, your thyroid might not produce enough hormones. This would slow down all of your body's functions, a condition known as **hypothyroidism** or underactive thyroid. Your thyroid could also produce too much hormone sending your systems into overdrive, a condition known as **hyperthyroidism** or overactive thyroid. These two conditions are most often features of an underlying thyroid disease.

When considering thyroid disease, doctors ask two main questions: First, is the thyroid gland inappropriately producing an abnormal amount of thyroid hormone? And second, is there a structural change in the thyroid, such as a lump—known as a **nodule** —or an enlargement—known as a **goiter**? Though one of these characteristics does not necessarily imply that the other is present, many thyroid disorders display both.

Out of Gas

Sometimes the thyroid can't meet your body's demands for thyroid hormone, even though TSH levels increase. As your body slows down, you may feel cold, tired and even depressed. You may gain weight, even though you're eating less.

There could be a number of reasons why your thyroid is not performing well. For example, if your body isn't getting enough iodine, your thyroid can't make enough thyroid hormone, but it will try to respond to rising TSH levels by working harder and harder anyway. This can cause your thyroid to become enlarged and develop into a goiter that looks like a protrusion or large swelling in your neck. Goiters used to be common, but they have become much less common in developed countries because of iodine-fortified foods.

In other cases, your thyroid comes under attack by your body's own immune system. Normally, substances called antibodies protect you from dangerous bacteria and viruses. But in this condition, known as **Hashimoto's thyroiditis**, your antibodies mistake your thyroid for a foreign invader. Hashimoto's thyroiditis involves the presence of two types of antibodies called antithyroid peroxidase (anti-TPO) and antithyroglobulin (anti-TG) antibodies. These antibodies play a role in the destruction of the thyroid by the immune system. Over time, your defenseless thyroid, inflamed and scarred, surrenders and fails. Ailments like Hashimoto's thyroiditis that result from an abnormal immune

response are called autoimmune diseases. Hashimoto's thyroiditis is but one form of **thyroiditis** —an inflammation of the thyroid—that causes hypothyroidism.

Sometimes your thyroid keeps churning out more thyroid hormone, even when your pituitary gland completely shuts down TSH production, a clear signal that your body has had enough. Yet the thyroid appears oblivious to the lack of signals and continues to produce too much, pushing your metabolism into overdrive and speeding up your body's processes. This is **hyperthyroidism**. If you're hyperthyroid, your pulse may be racing, you feel irritable and overheated, and you have trouble sleeping. You may lose weight in spite of a good appetite and experience anxiety and nervousness. As with hypothyroidism, you may develop a goiter; in this case, your thyroid enlarges because your thyroid is working so hard overproducing thyroid hormone.

A **toxic multinodular goiter** is to blame for hyperthyroidism in many people over 60 years old. This occurs when the thyroid enlarges and develops nodules, which are essentially lumps of thyroid cells that form as part of the thyroid. Nodules may develop on the outer surface of the gland where the doctor can feel them during an examination. If they develop inside the gland, however, they may not be apparent to the touch. Nodules throw off communication between the thyroid and the pituitary gland because they independently produce thyroid hormone and do not depend on TSH to produce hormone.

A type of single nodule, called a **solitary toxic adenoma**, causes hyperthyroidism in the same way—by producing thyroid hormone at its own whim, regardless of the messages from the pituitary gland.

Not all nodules cause thyroid imbalance. There are different kinds of single nodules that can range from the size of a pea, or even smaller, to the size of a plum, or even bigger. Most are completely harmless and don't affect thyroid function in the least. These include fluid-containing nodules called **cysts** and **adenomas**, which are solid but equally harmless. A very small percentage of nodules are cancerous. **Cancerous nodules** do not directly affect thyroid function and therefore do not cause an overactive or underactive thyroid.

Another cause of a revved-up thyroid is **Graves' disease**, an autoimmune disease that is the most common cause of hyperthyroidism in the United States. As with Hashimoto's thyroiditis, antibodies attack the thyroid, but in this case they stimulate the thyroid to overproduce thyroid hormone. The kinds of antibodies present in Graves' disease are known as thyrotropin receptor antibodies (TRAb), including one kind known as thyroid-stimulating immunoglobulins (TSIs). They work by mimicking TSH, attaching to the TSH receptor on the thyroid gland and confusing the thyroid into producing too much hormone.

In addition to symptoms of hyperthyroidism, some people with Graves' disease develop thyroid eye disease. Its features vary from case to case and may be characterized by swollen, bulging, red eyes; widely open eyelids; and double vision. In its most severe form, diminished visual acuity may be present.