

# Hyperthyroidism

National Endocrine and Metabolic Diseases Information Service



U.S. Department  
of Health and  
Human Services

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OF HEALTH



## What is hyperthyroidism?

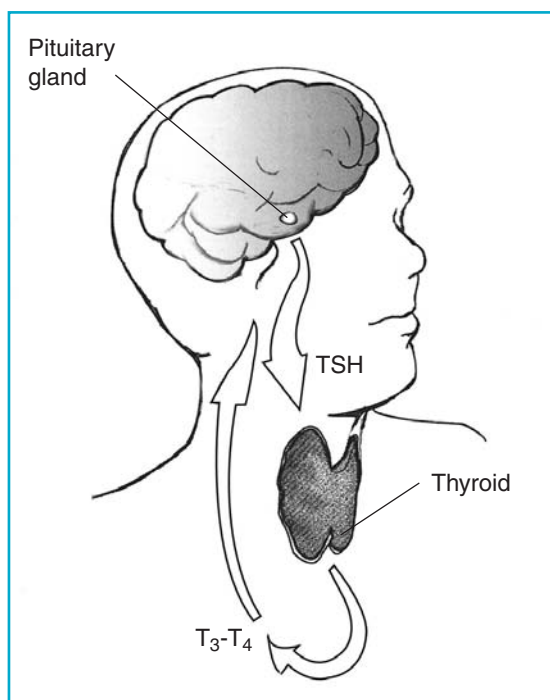
Hyperthyroidism is a disorder that occurs when the thyroid gland makes more thyroid hormone than the body needs. Hyperthyroidism is sometimes called thyrotoxicosis, the technical term for too much thyroid hormone in the blood. Thyroid hormones circulate throughout the body in the bloodstream and act on virtually every tissue and cell in the body. Hyperthyroidism causes many of the body's functions to speed up. About 1 percent of the U.S. population has hyperthyroidism.<sup>1</sup>

## What is the thyroid?

The thyroid is a 2-inch-long, butterfly-shaped gland weighing less than 1 ounce. Located in the front of the neck below the larynx, or voice box, it has two lobes, one on each side of the windpipe. The thyroid is one of the glands that make up the endocrine system. The glands of the endocrine system produce, store, and release hormones into the bloodstream. The hormones then travel through the body and direct the activity of the body's cells.

The thyroid gland makes two thyroid hormones, triiodothyronine (T<sub>3</sub>) and thyroxine (T<sub>4</sub>). T<sub>3</sub> is made from T<sub>4</sub> and is the more active hormone, directly affecting the tissues. Thyroid hormones affect metabolism, brain development, breathing,

<sup>1</sup>Golden SH, Robinson KA, Saldanha I, et al. Prevalence and incidence of endocrine and metabolic disorders in the United States: a comprehensive review. *Journal of Clinical Endocrinology Metabolism*. 2009;94(6):1853–1878.



The thyroid's production of thyroid hormones—T<sub>3</sub> and T<sub>4</sub>—is regulated by thyroid-stimulating hormone (TSH), which is made by the pituitary gland.

heart and nervous system functions, body temperature, muscle strength, skin dryness, menstrual cycles, weight, and cholesterol levels.

Thyroid hormone production is regulated by thyroid-stimulating hormone (TSH), which is made by the pituitary gland in the brain. When thyroid hormone levels in the blood are low, the pituitary releases more TSH. When thyroid hormone levels are high, the pituitary responds by decreasing TSH production.

## What causes hyperthyroidism?

Hyperthyroidism has several causes, including

- Graves' disease
- thyroid nodules
- thyroiditis, or inflammation of the thyroid
- consuming too much iodine
- overmedicating with synthetic thyroid hormone, which is used to treat underactive thyroid

Rarely, hyperthyroidism is caused by a pituitary adenoma, which is a noncancerous tumor of the pituitary gland. In this case, hyperthyroidism is due to too much TSH.

### Graves' Disease

Graves' disease, also known as toxic diffuse goiter, is the most common cause of hyperthyroidism in the United States. Graves' disease is an autoimmune disorder. Normally, the immune system protects the body from infection by identifying and destroying bacteria, viruses, and other potentially harmful foreign substances. But in autoimmune diseases, the immune system attacks the body's own cells and organs.

With Graves' disease, the immune system makes an antibody called thyroid stimulating immunoglobulin (TSI) that attaches to thyroid cells. TSI mimics the action of TSH and stimulates the thyroid to make too much thyroid hormone.

More information about Graves' disease is provided in the National Endocrine and Metabolic Diseases Information Service (NEMDIS) fact sheet *Graves' Disease* at [www.endocrine.niddk.nih.gov](http://www.endocrine.niddk.nih.gov).

### Thyroid Nodules

Thyroid nodules, also called adenomas, are lumps in the thyroid. Thyroid nodules are common and usually noncancerous. About 3 to 7 percent of the U.S. population has them.<sup>2</sup> However, nodules may become overactive and produce too much hormone.

A single overactive nodule is called a toxic adenoma. Multiple overactive nodules are called toxic multinodular goiter. Often found in older adults, toxic multinodular goiter can produce a large amount of excess thyroid hormone.

### Thyroiditis

Thyroiditis is an inflammation of the thyroid that causes stored thyroid hormone to leak out of the thyroid gland. At first, the leakage raises hormone levels in the blood, leading to hyperthyroidism that lasts for 1 or 2 months. Most people then develop hypothyroidism—when thyroid hormone levels are too low—before the thyroid is completely healed.

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<sup>2</sup>Gharib H, Papini E, Paschke R, et al. American Association of Clinical Endocrinologists, Associazione Medici Endocrinologi, and European Thyroid Association medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocrine Practice*. 2010;16(s1)1–43.

Several types of thyroiditis can cause hyperthyroidism followed by hypothyroidism:

- **Subacute thyroiditis.** This condition involves painful inflammation and enlargement of the thyroid. Experts are not sure what causes subacute thyroiditis, but it may be related to a viral or bacterial infection. The condition usually goes away on its own in a few months.
- **Postpartum thyroiditis.** This type of thyroiditis develops after a woman gives birth. For more information, see the section titled “What happens with pregnancy and thyroid conditions?”
- **Silent thyroiditis.** This type of thyroiditis is called “silent” because it is painless, as is postpartum thyroiditis, even though the thyroid may be enlarged. Like postpartum thyroiditis, silent thyroiditis is probably an autoimmune condition and sometimes develops into permanent hypothyroidism.

### Consuming Too Much Iodine

The thyroid uses iodine to make thyroid hormone, so the amount of iodine consumed influences the amount of thyroid hormone the thyroid makes. In some people, consuming large amounts of iodine may cause the thyroid to make excess thyroid hormone.

Sometimes significant amounts of iodine are contained in medications—such as amiodarone, which is used to treat heart problems—or in supplements containing seaweed. Some cough syrups also contain large amounts of iodine. See “Eating, Diet, and Nutrition” for more information on iodine.

### Overmedicating with Synthetic Thyroid Hormone

Some people who take synthetic thyroid hormone for hypothyroidism may take too much. People who take synthetic thyroid hormone should see their health care provider at least once a year to have their thyroid hormone levels checked and follow the health care provider’s instructions about the dosage.

Some other medications may also interact with synthetic thyroid hormone to raise hormone levels in the blood. People who take synthetic thyroid hormone should ask their health care provider about interactions when starting new medications.

### What are the symptoms of hyperthyroidism?

Hyperthyroidism has many symptoms that can vary from person to person. Some common symptoms of hyperthyroidism are

- nervousness or irritability
- fatigue or muscle weakness
- heat intolerance
- trouble sleeping
- hand tremors
- rapid and irregular heartbeat
- frequent bowel movements or diarrhea
- weight loss
- mood swings
- goiter, which is an enlarged thyroid that may cause the neck to look swollen and can interfere with normal breathing and swallowing

## Who is likely to develop hyperthyroidism?

Women are two to 10 times more likely than men to develop hyperthyroidism.<sup>1</sup> Certain factors can increase the chances of developing thyroid disorders. People may need more regular testing if they

- have had a thyroid problem before, such as goiter or thyroid surgery
- have a family history of thyroid disease
- have pernicious anemia, a B12 deficiency; type 1 diabetes; or primary adrenal insufficiency, a hormonal disorder
- eat large amounts of food containing iodine, such as kelp, or use iodine-containing medications such as amiodarone, a heart medication
- are older than age 60
- were pregnant or delivered a baby within the past 6 months

Getting tested routinely helps uncover thyroid problems—especially subclinical problems. Subclinical means a person has no apparent symptoms. Some health care providers treat subclinical hyperthyroidism immediately. Others prefer to leave it untreated but monitor their patients for signs that the condition is worsening.

## Hyperthyroidism in the Aging Population

Hyperthyroidism is more common in people older than age 60 and is often caused by thyroid nodules. Older adults do not always display the more common symptoms of the disorder. For this reason hyperthyroidism in this age group is sometimes misdiagnosed as depression or dementia—loss of intellectual abilities, sometimes with emotional disturbance and personality changes.

For example, older adults with hyperthyroidism may seem disinterested or withdraw socially. Older adults with hyperthyroidism may lose their appetites, whereas younger people with the condition tend to have increased appetites. Older adults may also have different physical symptoms and may be more at risk from subclinical hyperthyroidism than younger patients.

For people older than age 60, subclinical hyperthyroidism increases their chance of developing a rapid, irregular heartbeat, a condition known as atrial fibrillation, which may lead to heart failure or stroke. Untreated hyperthyroidism can also speed the bone-thinning disease osteoporosis, particularly in women, and increase the likelihood of bone fractures.

## What happens with pregnancy and thyroid conditions?

**Hyperthyroidism.** During pregnancy, hyperthyroidism is usually caused by Graves' disease and occurs in about one of every 500 pregnancies.<sup>3</sup> Uncontrolled hyperthyroidism raises the chance of miscarriage, preterm delivery, and preeclampsia—a dangerous rise in blood pressure in late pregnancy.

Hyperthyroidism in a newborn can result in rapid heart rate, which can lead to heart failure; early closure of the soft spot in the skull; poor weight gain; irritability; and sometimes an enlarged thyroid that can press against the windpipe and interfere with breathing.

Women with Graves' disease and their newborns should be closely monitored by their health care team. Women with hyperthyroidism should discuss their condition with their health care provider before becoming pregnant.

Symptoms of hyperthyroidism may be difficult to assess during pregnancy. Normally, the thyroid gland gets bigger in healthy women when they become pregnant. That normal enlargement, combined with fatigue, makes a new thyroid problem easy to miss. A rapid and irregular heartbeat, a slight tremor, and unexplained weight loss or failure to have normal pregnancy weight gain are signs that hyperthyroidism could be developing.

**Postpartum thyroiditis.** This inflammation of the thyroid gland affects about 4 to 10 percent of women in the first year after giving birth.<sup>4</sup> Postpartum thyroiditis causes hyperthyroidism that usually lasts for 1 to 2 months and is believed to be an autoimmune condition.

Women with postpartum thyroiditis often develop hypothyroidism before the thyroid gland is completely healed. The condition is likely to recur with future pregnancies.

Postpartum thyroiditis sometimes goes undiagnosed because the symptoms are mistaken for postpartum blues—the exhaustion and moodiness that sometimes follow delivery. If symptoms of fatigue and lethargy do not go away within a few months or a woman develops postpartum depression, she should talk with her health care provider. She may have developed a permanent thyroid condition and will need to take medication.

More information about pregnancy and thyroid disease is provided in the NEMDIS fact sheet *Pregnancy and Thyroid Disease* at [www.endocrine.niddk.nih.gov](http://www.endocrine.niddk.nih.gov).

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<sup>3</sup>Komal PS, Mestman JH. Graves hyperthyroidism and pregnancy: a clinical update. *Endocrine Practice*. 2010;16(1):118–129.

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<sup>4</sup>Ogunyemi DA. Autoimmune thyroid disease and pregnancy. *emedicine website*. <http://emedicine.medscape.com/article/261913-overview>. Updated March 12, 2012. Accessed April 10, 2012.

## How is hyperthyroidism diagnosed?

Many symptoms of hyperthyroidism are the same as those of other diseases, so hyperthyroidism usually cannot be diagnosed based on symptoms alone. With suspected hyperthyroidism, health care providers take a medical history and perform a thorough physical exam. Health care providers may then use several blood tests, such as the following, to confirm a diagnosis of hyperthyroidism and find its cause:

**TSH test.** The ultrasensitive TSH test is usually the first test a health care provider performs. This test detects even tiny amounts of TSH in the blood and is the most accurate measure of thyroid activity available. The TSH test is especially useful in detecting mild hyperthyroidism. Generally, a TSH reading below normal means a person has hyperthyroidism and a reading above normal means a person has hypothyroidism.

Health care providers may conduct additional tests to help confirm the diagnosis or determine the cause of hyperthyroidism.

**T<sub>3</sub> and T<sub>4</sub> test.** This test shows the levels of T<sub>3</sub> and T<sub>4</sub> in the blood. With hyperthyroidism, the levels of one or both of these hormones in the blood are higher than normal.

**Thyroid-stimulating immunoglobulin (TSI) test.** This test, also called a thyroid-stimulating antibody test, measures the level of TSI in the blood. Most people with Graves' disease have this antibody, but people whose hyperthyroidism is caused by other conditions do not.

**Radioactive iodine uptake test.** The radioactive iodine uptake test measures the amount of iodine the thyroid collects from the bloodstream. Measuring the amount of iodine in a person's thyroid helps the health care provider determine what is causing a person's hyperthyroidism. For example, low levels of iodine uptake might be a sign of thyroiditis, whereas high levels could indicate Graves' disease.

**Thyroid scan.** A thyroid scan shows how and where iodine is distributed in the thyroid. The images of nodules and other possible irregularities help the health care provider diagnose the cause of a person's hyperthyroidism.

More information about testing for thyroid problems is provided in the NEMDIS fact sheet *Thyroid Function Tests* at [www.endocrine.niddk.nih.gov](http://www.endocrine.niddk.nih.gov).

## How is hyperthyroidism treated?

Health care providers treat hyperthyroidism with medications, radioiodine therapy, or thyroid surgery. The aim of treatment is to bring thyroid hormone levels to a normal state, thus preventing long-term complications, and to relieve uncomfortable symptoms. No single treatment works for everyone.

Treatment depends on the cause of hyperthyroidism and how severe it is. When choosing a treatment, health care providers consider a patient's age, possible allergies to or side effects of the medications, other conditions such as pregnancy or heart disease, and the availability of an experienced thyroid surgeon.

Finding the right specialist for treatment is an important first step. Some professional societies, listed under “For More Information,” and endocrinology departments in local teaching hospitals can provide the names of local specialists.

## Medications

**Beta blockers.** Health care providers may prescribe a medication called a beta blocker to reduce symptoms until other treatments take effect. Beta blockers act quickly to relieve many of the symptoms of hyperthyroidism, such as tremors, rapid heartbeat, and nervousness, but do not stop thyroid hormone production. Most people feel better within hours of taking these medications.

**Antithyroid medications.** Antithyroid therapy is the easiest way to treat hyperthyroidism. Antithyroid medications interfere with thyroid hormone production but don’t usually have permanent results. Antithyroid medications are not used to treat thyroiditis.

Once treatment with antithyroid medications begins, thyroid hormone levels may not move into the normal range for several weeks or months. The average treatment time is about 1 to 2 years, but treatment can continue for many years.

Antithyroid medications can cause side effects in some people, including

- allergic reactions such as rashes and itching
- a decrease in the number of white blood cells in the body, which can lower resistance to infection
- liver failure, in rare cases

Stop your antithyroid medication and call your health care provider right away if you develop any of the following while taking antithyroid medications:

- fatigue
- weakness
- vague abdominal pain
- loss of appetite
- skin rash or itching
- easy bruising
- yellowing of the skin or whites of the eyes, called jaundice
- persistent sore throat
- fever

In the United States, health care providers prescribe the antithyroid medication methimazole (Tapazole, Northyx) for most types of hyperthyroidism.

**Antithyroid medications and pregnancy.** Because pregnant and breastfeeding women cannot receive radioiodine therapy, they are usually treated with an antithyroid medication instead. However, experts agree that women in their first trimester of pregnancy should not take methimazole due to the rare occurrence of damage to the fetus. Another antithyroid medication, propylthiouracil (PTU), is available for women in this stage of pregnancy or for women who are allergic to or intolerant of methimazole and have no other treatment options.

Health care providers may prescribe PTU for the first trimester of pregnancy and switch to methimazole for the second and third trimesters. Some women are able to stop taking antithyroid medications in the last 4 to 8 weeks of pregnancy due to the remission of hyperthyroidism that occurs during pregnancy. However these women should continue to be monitored for recurrence of thyroid problems following delivery.

Studies have shown that mothers taking antithyroid medications may safely breastfeed. However, they should take only moderate doses, less than 10–20 milligrams daily, of the antithyroid medication methimazole. Doses should be divided and taken after feedings, and the infants should be monitored for side effects.<sup>4</sup>

Women requiring higher doses of the antithyroid medication to control hyperthyroidism should not breastfeed.

### **Radioiodine Therapy**

Radioactive iodine-131 is a common and effective treatment for hyperthyroidism. In radioiodine therapy, patients take radioactive iodine-131 by mouth. Because the thyroid gland collects iodine to make thyroid hormone, it will collect the radioactive iodine from the bloodstream in the same way. The radioactive iodine gradually destroys the cells that make up the thyroid gland but does not affect other body tissues.

More than one round of radioiodine therapy may be needed to bring thyroid hormone production into the normal range. In the meantime, treatment with beta blockers can control symptoms.

Almost everyone who receives radioactive iodine treatment eventually develops hypothyroidism. But health care providers consider this an acceptable outcome because hypothyroidism is easier to treat and has fewer long-term complications than hyperthyroidism. People who develop hypothyroidism must take synthetic thyroid hormone.

**Radioiodine and pregnancy.** Although iodine-131 is not known to cause birth defects or infertility, radioiodine therapy is not used in pregnant women or women who are breastfeeding. Radioactive iodine can be harmful to the fetus' thyroid and can be passed from mother to child in breast milk. Experts recommend that women wait a year after treatment before becoming pregnant.

### **Thyroid Surgery**

The least-used treatment is surgery to remove part or most of the thyroid gland. Sometimes surgery may be used to treat

- pregnant women who cannot tolerate antithyroid medications
- people with large goiters
- people who have cancerous thyroid nodules, though hyperthyroidism does not cause cancer



Before surgery, the health care provider may prescribe antithyroid medications to temporarily bring a patient's thyroid hormone levels into the normal range. This presurgical treatment prevents a condition called thyroid storm—a sudden, severe worsening of symptoms—that can occur when hyperthyroid patients have general anesthesia.

When part of the thyroid is removed—as a treatment for toxic nodules, for example—thyroid hormone levels may return to normal. But some surgical patients may still develop hypothyroidism and need to take synthetic thyroxine, a medication that is identical to the hormone, T<sub>4</sub>, made by the thyroid. If the entire thyroid is removed, lifelong thyroid hormone medication is necessary. After surgery, health care providers will continue to monitor patients' thyroid hormone levels.

Although uncommon, certain problems can occur in thyroid surgery. The parathyroid glands can be damaged because they are located very close to the thyroid. These glands help control calcium and phosphorus levels in the body. Damage to the laryngeal nerve, also located close to the thyroid, can lead to voice changes or breathing problems. But when surgery is performed by an experienced surgeon, less than 1 percent of patients have permanent complications.<sup>5</sup> People who need help finding a surgeon can contact one of the organizations listed under “For More Information.”

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<sup>5</sup>Yeung SJ, Habra MA, Chiu AC. Graves disease. emedicine website. <http://emedicine.medscape.com/article/120619-overview>. Updated September 30, 2011. Accessed April 10, 2012.

## Eating, Diet, and Nutrition

Experts recommend that people eat a balanced diet to obtain most nutrients. More information about diet and nutrition is provided by the National Agricultural Library at [www.nutrition.gov](http://www.nutrition.gov).

### Dietary Supplements

Iodine is an essential mineral for the thyroid. However, people with autoimmune thyroid disease may be sensitive to harmful side effects from iodine. Taking iodine drops or eating foods containing large amounts of iodine—such as seaweed, dulse, or kelp—may cause or worsen hyperthyroidism. More information about iodine is provided by the National Library of Medicine in the fact sheet, *Iodine in diet*, available at [www.nlm.nih.gov/medlineplus](http://www.nlm.nih.gov/medlineplus).

Women need more iodine when they are pregnant—about 250 micrograms a day—because the baby gets iodine from the mother's diet. In the United States, about 7 percent of pregnant women may not get enough iodine in their diet or through prenatal vitamins.<sup>6</sup> Choosing iodized salt—salt supplemented with iodine—over plain salt and prenatal vitamins containing iodine will ensure this need is met.

To help ensure coordinated and safe care, people should discuss their use of dietary supplements, such as iodine, with their health care provider. Tips for talking with health care providers are available from the National Center for Complementary and Alternative Medicine's Time to Talk campaign at [www.nccam.nih.gov](http://www.nccam.nih.gov).

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<sup>6</sup>Zimmerman MB. Iodine deficiency in pregnancy and the effects of maternal iodine supplementation on the offspring: a review. *American Journal of Clinical Nutrition*. 2009;89(2):668S–672S.

## Points to Remember

- Hyperthyroidism is a disorder that occurs when the thyroid gland makes more thyroid hormone than the body needs.
- Hyperthyroidism is most often caused by Graves' disease, an autoimmune disorder. Other causes include thyroid nodules, thyroiditis, consuming too much iodine, and overmedicating with synthetic thyroid hormone.
- Some symptoms of hyperthyroidism are nervousness or irritability, fatigue or muscle weakness, heat intolerance, trouble sleeping, hand tremors, rapid and irregular heartbeat, frequent bowel movements or diarrhea, weight loss, mood swings, and goiter.
- Hyperthyroidism is much more common in women than men.
- Hyperthyroidism is also more common in people older than age 60 and is often caused by thyroid nodules. Hyperthyroidism in this age group is sometimes misdiagnosed as depression or dementia. For people older than age 60, subclinical hyperthyroidism increases their chance of developing atrial fibrillation.
- Women with hyperthyroidism should discuss their condition with their health care provider before becoming pregnant.
- Hyperthyroidism is treated with medications, radioiodine therapy, or thyroid surgery. No single treatment works for everyone.

## Hope through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports research into many kinds of disorders, including Graves' disease. Researchers throughout the United States and the world are working to better understand, prevent, and treat this disease.

National Institutes of Health (NIH)-supported scientists are investigating the development, signs and symptoms, and genetics of thyroid function disorders to further understand thyroid diseases. Scientists continue to study treatment options for hyperthyroidism and other thyroid disorders.

The following federally funded research studies and clinical trials are currently under way:

- Evaluation of Patients With Thyroid Disorders, funded under NIH clinical trial number NCT00001159
- Trial of Rituximab for Graves' Ophthalmopathy, funded under NIH clinical trial number NCT00595335
- Phase II Randomized Controlled Study of Sequential Orbital Radiotherapy for Graves' Ophthalmopathy, funded under NIH clinical trial number NCT00004660

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For information about current studies, visit [www.ClinicalTrials.gov](http://www.ClinicalTrials.gov).

## For More Information

### **American Academy of Otolaryngology— Head and Neck Surgery**

1650 Diagonal Road  
Alexandria, VA 22314-2857  
Phone: 703-836-4444  
Internet: [www.entnet.org](http://www.entnet.org)

### **American Association of Clinical Endocrinologists**

245 Riverside Avenue, Suite 200  
Jacksonville, FL 32202  
Phone: 904-353-7878  
Fax: 904-353-8185  
Internet: [www.aace.com](http://www.aace.com)

### **American Thyroid Association**

6066 Leesburg Pike, Suite 550  
Falls Church, VA 22041  
Phone: 1-800-THYROID  
(1-800-849-7643) or 703-998-8890  
Fax: 703-998-8893  
Email: [thyroid@thyroid.org](mailto:thyroid@thyroid.org)  
Internet: [www.thyroid.org](http://www.thyroid.org)

### **The Endocrine Society**

8401 Connecticut Avenue, Suite 900  
Chevy Chase, MD 20815  
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### **Graves' Disease and Thyroid Foundation**

P.O. Box 2793  
Rancho Santa Fe, CA 92067  
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Internet: [www.gdatf.org](http://www.gdatf.org)

### **The Hormone Foundation**

8401 Connecticut Avenue, Suite 900  
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You may also find additional information about this topic by visiting MedlinePlus at [www.medlineplus.gov](http://www.medlineplus.gov).

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