Hypothyroidism

What Is Hypothyroidism?

Thyroid Gland

The thyroid is a small, butterfly-shaped gland located in the front of the neck that produces hormones that increase oxygen use in cells and stimulate vital processes in every part of the body. These thyroid hormones have a major impact on growth, use of energy, heat production, and infertility. They affect the use of vitamins, proteins, carbohydrates, fats, electrolytes, and water, and regulate the immune response in the intestine. They can also alter the actions of other hormones and drugs.

Thyroid Hormones

An understanding of the complex thyroid hormone process begins with iodide, a salt that is extracted from the blood and trapped by the thyroid gland. Here it is converted to iodine, where 80% of the body's iodine supply is then stored. Iodine is the raw material used in the manufacture of ***thyroxine (T4),*** the key thyroid hormone.

Thyroxine itself is converted into ***triiodothyronine (T3)*** **,** which is the more biologically active thyroid hormone. Only about 20% of triiodothyronine is actually formed in the thyroid gland, however. The rest is manufactured from circulating thyroxine in tissues outside the thyroid, such as those in the liver and kidney. Once these thyroid hormones are in circulation, a large fraction binds to other substances called thyroid hormone transport proteins, and it becomes inactive. In fact, only 0.03% of thyroxine and 0.5% of triiodothyronine is free, that is, unbound and biologically active.

Two other important hormones in the process are ***thyroid-stimulating hormone*** (***TSH*** or ***thyrotropin***) and ***thyrotropin-releasing hormone*** (***TRH***). TSH directly influences the whole process of iodine trapping and thyroid hormone production. This hormone is secreted by the pituitary gland and monitored by thyrotropin-releasing hormone, which is produced in the hypothalamus gland. (Both the pituitary and hypothalamus glands are located in the brain.) When thyroxine levels drop even slightly, the pituitary gland goes into action to pump up secretion of TSH so that it can stimulate thyroxine production.

Any abnormality in this intricate system of glands and hormone synthesis and production can have far-reaching consequences.

Hypothyroidism

Hypothyroidism occurs when secretion of thyroid hormones is inadequate to the point that the body begins to slow down. Hypothyroidism was first diagnosed in the late nineteenth century when physicians observed that after surgically removing the thyroid gland, a patient developed swelling of the hands, face, feet, and tissues around the eye. They named this syndrome ***myxedema*** and correctly concluded that it was the outcome of the absence of substances, thyroid hormones, normally produced by the thyroid gland. Hypothyroidism is usually progressive and irreversible. Treatment, however, is nearly always completely successful and allows a patient to live a fully normal life.

What Causes Hypothyroidism?

Many permanent or temporary conditions can reduce thyroid hormone secretion and cause hypothyroidism. The most common of these are Hashimoto's thyroiditis, an autoimmune condition, and overtreatment of *hyper*thyroidism. About 95% of hypothyroidism cases occur from problems that originate in the thyroid gland. In such cases, the disorder is called primary hypothyroidism. In some cases, it is caused disorders of the pituitary gland (when it is known as secondary hypothyroidism) or hypothalamus gland (tertiary hypothyroidism).

Autoimmune Thyroiditis

Autoimmune thyroiditis is a primary hypothyroid disease. In any autoimmune disease, the body's immune system attacks its own cells. In the case of autoimmune thyroiditis, the cells under attack are in the thyroid gland. Experts do not know why the immune system starts to injure the thyroid. One theory is that a virus or bacteria with a protein resembling a thyroid protein might trigger the response. This theory is backed up to some extent by the presence of recent infections in people with autoimmune disease. There is an association between hepatitis C, for instance, and the onset of autoimmune hypothyroidism. Some experts believe the infectious-disease theory is not convincing. An alternative hypothesis is that certain patients have abnormal thyroid cells, possibly from a genetic defect, that provoke a suicidal process called ***apoptosis*** that leads to a direct attack by T-cells, important agents in the immune-system. The most common autoimmune diseases of the thyroid are Hashimoto's thyroiditis, atrophic thyroiditis, and postpartum thyroiditis.

Hashimoto's Thyroiditis. The most common form of hypothyroidism in the US is Hashimoto's thyroiditis, a genetic disease named after the Japanese physician who first described thyroid inflammation in 1912. It occurs in approximately 0.3 to 5 people per 1000 per year, and women are 15 to 20 times more likely than men to develop this disease. An enlargement of the thyroid gland called a *goiter* is almost always present, which may appear as a cyst-like or fibrous growth in the neck. Hashimoto's thyroiditis is permanent and requires life-long treatment. Both genetic and environmental factors appear to play a role in its development.

Atrophic Thyroiditis. Atrophic thyroiditis is similar to Hashimoto's thyroiditis, except a goiter is not present.

Riedel's Thyroiditis. In a rare autoimmune disorder known as Riedel's thyroiditis, patients develop a hard stony mass that suggests cancer, but the disorder responds well to thyroid replacement and steroids.

Pregnancy-Induced Hypothyroidism

Women are at much higher risk for hypothyroidism during or after pregnancy, which affects the thyroid in a number of ways. Iodine requirements increase because of the needs of both the mother and the fetus. Reproductive hormones cause changes in thyroid hormone levels. Often, however, hypothyroidism occurs because women develop antibodies to their own thyroid during pregnancy, causing an inflammation of the thyroid after delivery. Autoimmune thyroiditis occurs in up to 5% of pregnant women and tends to develop between four and 12 months after delivery (and so is called postpartum autoimmune thyroiditis). It almost always resolves on its own. However, in one study of women who had postpartum thyroiditis, hypothyroidism developed three to five years after the pregnancy in 23% of cases. Occasionally, postpartum hypothyroidism can also be permanent after pregnancy, particularly in women who have had recurrent episodes after previous pregnancies and in women who have other autoimmune disorders. Postpartum thyroiditis may be interrupted by bouts of hyperthyroidism as well.

Iodide Abnormalities

Too much or too little iodide can cause hypothyroidism. If there is a deficiency of iodide, then the body cannot manufacture thyroxine. Too much iodide is a signal to inhibit the conversion process of thyroxine to T3. The end result in both cases is inadequate production of thyroid hormones.

Iodine Deficiencies. Diets deficient in iodine can lead to hypothyroidism. About 200 million people around the world have hypothyroidism because of insufficient iodine in their diets. The presence of iron-deficiency anemia, another problem prevalent among iodine-deficient children in developing countries, further exacerbates hypothyroidism in these children and impedes the efficacy of iodine supplementation. Iron supplements may enhance the effects of iodine intake. (Iron supplements can be very dangerous in children, even at normal adult levels; no one should give children iron without a physician's recommendation.)

One African study reported that when iodine replacement reduced hypothyroidism rates in areas where food supplies, were low, the population's energy levels and fertility increasedl this then placed a higher burden on already low resources. Experts warn that in developing countries, all concerns must be addressed.

Although hypothyroidism from iodine deficiency is still very uncommon in nations where iodine has been added to salt, the consumption of iodized salt has declined over the past decades. In addition, iodine levels have been reduced in animal feed and bread products. Experts believe this may be causing an increase in subclinical hypothyroidism (without symptoms) even in developed countries.

Excess Iodine. Excess iodine intake tends to suppress the production of thyroid hormones in anyone. In people with antibodies to their own thyroid but no symptoms of autoimmune thyroiditis, an increase in iodine can bring on symptoms. Countries with the highest intake of iodine, including the US and Japan, have the highest prevalence of chronic autoimmune thyroiditis, and when people in countries deficient in iodine are given iodine supplements, the rate of this disorder increases.

Treatment of Hyperthyroidism

Graves' disease is the most common form of *hyper*thyroidism, a condition caused by *excessive* secretion of thyroid hormones. Up to half of patients who receive radioactive iodide, the standard treatment for Graves' disease, develop permanent hypothyroidism within a year of therapy. By the end of five years, about 65% of patients have developed hypothyroidism, after which the rate of hypothyroidism levels off to about 1% a year. Such patients need to take thyroid hormones for the rest of their lives. Other forms of treatment for overactive thyroid glands using either antithyroid drugs or surgery may also result in hypothyroidism. [*See* Thyroid Surgery, *below.*] One interesting theory holds that Graves' disease and Hashimoto's thyroidism are caused by a similar immunologic dysfunction, and that they are essentially two sides of a single coin. Because the antibodies present in both diseases are similar, some experts believe that the predominance of one or another antibody determines which of the diseases become manifest.

Thyroid Surgery

Complete removal (total thyroidectomy) of the thyroid to treat thyroid cancer requires a lifetime of treatment with an appropriate dosage of thyroid hormone. Removing one of the two lobes of the thyroid gland (hemithyroidectomy) because of benign growths on the thyroid gland, rarely produces hypothyroidism. The remaining thyroid lobe will generally enlarge so that it can produce sufficient amounts of thyroid hormone for normal function. Many physicians recommend thyroid hormone treatment, however, to prevent the formation of additional nodules. The small

percentage of Graves' disease patients who require surgery to remove most of both thyroid lobes (subtotal thyroidectomy) may develop hypothyroidism. It is important to find an experienced surgeon for this procedure and to have the thyroid checked at six- or 12-month intervals.

Causes of Hypothyroidism in Infants

Permanent Congenital Hypothyroidism. Hypothyroidism in newborns (known as *congenital* hypothyroidism) occurs in about .04% of infants, and in 90% of these cases it is life long. The development of the thyroid, pituitary, and hypothalamus and the mechanisms that affect hormone production is a complex one and any one of many abnormalities during pregnancy can cause hypothyroidism. In up to 85% of congenital hypothyroidism cases, the thyroid gland is either missing, underdeveloped, or not properly located. There does not appear to be any inherited factor or recognizable cause in the great majority of these cases. In about 10% to 15% of cases, there are abnormalities in the processes involved in hormone production. Most of these cases are likely to be due to inherited factors. In less than 5% of cases, the pituitary or hypothalamus glands function abnormally. The causes of this situation vary and can include inherited or brain abnormalities.

Temporary Hypothyroidism in Infants. Temporary hypothyroidism can also occur in premature infants from various factors:

- Autoimmune thyroid disease and thyroid dysfunction in the mother may be responsible for about half of the cases of temporary hypothyroidism in infants.
- Temporary hypothyroidism in infants can also occur in mothers who are being treated for thyroid disease.
- The central nervous system connections between the hypothalamus and pituitary glands may also mature late; this condition generally resolves between four to 16 weeks after birth.

Drugs that Reduce Thyroid Levels

Lithium. Lithium, a drug widely used to treat psychiatric disorders, has multiple effects on thyroid hormone synthesis and secretion. Up to 50% of patients who take lithium develop goiter, with 20% developing symptomatic hypothyroidism, and another 20% to 30% developing hypothyroidism without symptoms.

Amiodarone. The drug amiodarone (Cordarone), which is used to treat abnormal heart rhythms, contains iodine and can induce hyper- or hypothyroidism, particularly in patients with an existing thyroid problem. Hypothyroidism is the more common effect in the US, where dietary iodine is abundant, although hyperthyroidism is not an unknown effect.

Antiseizure Agents. Drugs used for epilepsy, including phenytoin and carbamazepine, reduce thyroid levels.

Other Drugs. Certain antidepressants may cause hypothyroidism, although this effect is infrequent. Many other drugs contain iodine or have properties that affect the thyroid, although their effects are almost always reversible when they are stopped. Large doses of selenium, a common over-the-counter supplement, may lower thyroid levels. Some drugs used in chemotherapy can cause hypothyroidism.

Radiation

High-dose radiation for cancers of the head or neck and for Hodgkin's disease can cause hypothyroidism in up to 65% of patients within 10 years after treatment. Exposure to radiation from nuclear power plants may be associated with thyroid disorders, but further research is needed. A study of children living near Chernobyl during the nuclear accident in 1986 found that nearly 20% of them who were heavily exposed to radiation had indications of thyroid autoantibodies. Females who at the time were older than 13 years old had the highest risk. At the time of the study, in 1992 and 1994, none of the children had developed hypothyroidism, but experts recommended monitoring them. In another study of people exposed to radioactive iodine from the Hanford Nuclear Site between 1955 to 1957, individuals exposed to high doses were no more likely to develop thyroid disease than those who were exposed to low doses. The study did not address whether radiation exposure caused an increase of thyroid disease in general, however.

Secondary and Tertiary Hypothyroidism

In rare instances, usually due to a tumor, the pituitary gland will fail to produce thyrotropin (TSH), the hormone that stimulates the thyroid to produce its hormones. In such cases, the thyroid gland withers. When this happens, secondary hypothyroidism occurs.

What Are The Symptoms Of Hypothyroidism?

Subclinical Hypothyroidism

In adults, hypothyroidism may develop so gradually that it is often first diagnosed when blood tests indicate slightly elevated TSH levels before symptoms even occur. This condition, called subclinical hypothyroidism, occurs in about 7% of all women and 3% of men. In some studies, up to 20% of people over 60, mostly women, have subclinical hypothyroidism. (Some experts believe that the term "subclinical" is inappropriate. They believe that in most cases, the condition is already mild hypothyroidism that causes symptoms such as fatigue, which are attributed to other factors.) Subclinical hypothyroidism progresses to overt hypothyroidism in about 2% of all untreated people per year. In older women, however, the rate is much faster, about 17% per year. The symptoms increase as the disease progresses and the metabolism slows down.

Symptomatic Hypothyroidism

Early Symptoms:

- Many people attribute the early symptoms of hypothyroidism to stress or aging, including feeling chronically tired and overly sensitive to cold.
- In one study, 30% of people with hypothyroidism developed headaches within one to two months of the onset of the thyroid disorder. Those with a history of migraines were at higher risk for this symptom. The headaches were mild but continuous and on both sides of the head.
- Muscle and joint aches often develop.
- Weight gain is common even though appetite diminishes.
- Constipation can be a problem.
- Premenopausal women may experience heavy periods or, in rare cases, a milky discharge from the breasts.
- A history of miscarriage may be a sign of impending hypothyroidism. Studies suggest that even if thyroid levels are normal, women who have a history of miscarriages often have antithyroid antibodies during early pregnancy and are at risk for developing autoimmune thyroiditis over time.

Later Symptoms. As free thyroxine levels fall over the following months, other symptoms develop:

- Mental activity, including concentration and memory, may become slightly impaired, particularly in the elderly.
- Depression develops. Some experts believe that even mild thyroid failure may increase susceptibility to major depression.
- Hypothyroidism affects muscles. Weakness and pain may occur. Muscle cramps are common. In some cases it causes carpal tunnel syndrome or symptoms similar to gout or arthritis. In some cases the arms and legs may feel numb.
- Some people experience hearing loss.
- The voice may become husky.
- Obstructive sleep apnea is common, in which tissues in the upper throat collapse at intervals during sleep, thereby blocking the passage of air.
- If untreated, the classic physical changes characteristic of myxedema can develop: a round puffy face with a sleepy appearance, dry, rough skin, and loss of hair.

Symptoms of Secondary Hypothyroidism (Caused by Pituitary Growth)

Secondary hypothyroidism, caused by pituitary growth, produces the usual symptoms of primary hypothyroidism, and, in addition, sexual drive and fertility may be impaired in both men and women. Patients may also be exhausted, crave salt, and have low blood pressure. Headaches and visual disturbances may develop, which are directly related to the pituitary tumor.

Symptoms in Infants and Children

All babies are now screened for hypothyroidism in order to prevent retardation that can occur if the disorder is not detected early. Symptoms of hypothyroidism in children vary depending on when it first develops.

- Most children who are born with a defect that causes congenital hypothyroidism have no obvious symptoms. When symptoms do exist in the newborn they may include the following: jaundice (yellowish skin), noisy breathing, and enlarged tongue.
- If hypothyroidism is not detected and treated, early symptoms in the infant include the following: feeding problems, failure to thrive, constipation, hoarseness, and sleepiness.
- Later on, symptoms in untreated children include protruding abdomens, rough, dry skin, and delayed teething.
- If they do not receive proper treatment in time, children with hypothyroidism may be extremely short for their age, have a puffy, bloated appearance, and have below-normal intelligence. Any child whose growth is abnormally slow should be examined for hypothyroidism.

How Is Hypothyroidism Diagnosed?

Advances in diagnostic methods now make it possible to detect hypothyroidism in almost all cases before severe symptoms develop. Physicians can make the diagnosis of hypothyroidism after completing a history and physical exam of the patient and performing sensitive laboratory tests on the patient's blood. [*See Box,* Screening Recommendations for Hypothyroidism.]

Measuring Thyroid Hormone Levels

Measurement of TSH. Blood tests that measure thyroid-stimulating hormone (TSH or thyrotropin) levels are the most sensitive indicators of hypothyroidism:

When thyroxine (T4) levels drop even slightly, the pituitary gland goes into action to pump up secretion of TSH so that it can stimulate thyroxine production. In fact, thyroxine may still be within normal range when the pituitary begins to increase the supply of TSH.

- Normal levels are generally between 0.5 to 5.0 mU/L. If TSH levels are elevated above 6 mU/L, regardless of thyroxine levels, the physician can still make a diagnosis of hypothyroidism.
- In nearly all cases, thyroid replacement treatments should begin when levels are above 10mU/L.
- It is not clear, however, at what point subclinical hypothyroidism (generally between 5 mU/l and 10 mU/L) should be treated. (The condition is referred to as subclinical if TSH is elevated but thyroxine levels are normal and the patient has no obvious symptoms.)

Measurement of other Thyroid Hormones. Thyroxine itself is sometimes measured. For instance, in the very elderly **,** seriously ill patients **,** and during pregnancy **,** both thyroxine and TSH levels may be extremely variable. Therefore, the physician should repeat measurements of *both* hormones before starting thyroid-hormone therapy in such patients.

Additional tests may improve accuracy, including tests known as free thyroxine (fT4), T3 resin uptake, and sensitive thyroid-stimulating hormone (sTSH) assays **.**

Physical Examination

The presence of a goiter (an enlarged thyroid), especially a rubbery, painless one, may be an indication of Hashimoto's disease. If the thyroid is tender and enlarged but not necessarily symmetrical, the physician may suspect subacute thyroiditis. A diffusely enlarged gland may occur in hereditary hypothyroidism, in postpartum patients, or from use of iodides or lithium. The physician will check the heart, eyes, hair, skin, and reflexes. Women who are experiencing menopausal symptoms which may be masking those of hypothyroidism should perform a simple self-examination called the Thyroid Neck Check. [*See Box* Thyroid Neck Check.]

Thyroid Neck Check

Hold a mirror in front of the area of the neck where the thyroid gland is located: just below the Adam's apple and right above the collarbone. (Note: The Adam's apple is *not* the thyroid location.)

Tip the head back.

Take a drink of water and swallow, watching the neck during the process.

Check for any bulging or protrusions. If any is detected, call a physician for a check up.

Antithyroid Antibodies

A blood test for certain antithyroid antibodies is sometimes used to detect Hashimoto's thyroiditis, particularly in patients who have knobby goiters. If high levels of antibodies are present

Hashimoto's thyroiditis is a certain diagnosis. Even if patients have no symptoms at the time of the test, a positive result usually means that a patient has a 4% to 8% chance of developing symptoms each year.

Imaging Tests

Scintigraphy. Thyroid scintigraphy tests scan the thyroid and pick up images highlighted by small amounts of radioactive substances. Thyroid scans can be used to determine whether the thyroid is producing normal amounts of hormone. The patient drinks a small amount of radioactive iodine or technetium and waits until it has been through the thyroid. Images of a properly functioning thyroid would show uniform levels of absorption throughout the gland. Overactive areas would show up white and underactive areas would appear dark. Thyroid scans are usually unnecessary unless the physician needs to rule out suspected cancer.

Ultrasound. Ultrasound has limited value, but it can visualize the thyroid and specific abnormalities, such as nodules. (It cannot measure the thyroid gland's function, however.)

More Advanced Imaging Tests. If laboratory tests suggest that a pituitary or hypothalamus problem is causing hypothyroidism, the physician will usually order brain imaging procedures using computed tomography (CT) scans or magnetic resonance imaging (MRI). MRIs may also be used for determining the extent of thyroid cancers and of goiters. MRIs are also being used for investigating hypothyroidism in infants and for determining widespread effects of autoimmune thyroiditis (such as Hashimoto's hypothyroidism).

Needle Aspiration Biopsy

Needle aspiration biopsy is a common procedure performed in a doctor's office and used to obtain thyroid cells for microscopic evaluation. Much like drawing blood, the physician injects a small needle into the thyroid gland and draws cells from the gland into a syringe. The cells are put onto a slide, stained, and examined under a microscope. It may be used for patients with suspected Hashimoto's hypothyroidism, especially if they have difficulty swallowing or develop a goiter.

Other Blood Tests

Other blood tests may be performed to detect levels of calcitonin, calcium, prolactin, and thyroglobulin and to check for anemia and liver function, all of which may be affected by hypothyroidism.

Screening Recommendations For Hypothyroidism

Screening in Older Adults

Some physicians believe that because thyroid problems are so common in the elderly and thyroid hormone tests are so inexpensive, blood tests for thyroid function should be routine. Undiagnosed hypothyroidism in elderly patients can develop into a serious and even life-threatening situation. Hyperthyroidism also

poses many health risks. In fact, during the period around menopause, the symptoms of menopause and hypothyroidism are similar and can easily be confused with each other. The American College of Physicians now recommends that women over 50 years old should be screened for thyroid disorders every five years. The American Thyroid Association, however, recommends that all adults, both men and women, begin their screening at age 35 and every five years afterward. Experts argue that such early screening is inexpensive and would prevent progression to hypothyroidism, and therefore possibly heart disease, in people with subclinical hypothyroidism. Other experts feel, however, that cholesterol levels can be lowered through other means and that there is no evidence that treating people who have only mildly abnormal thyroid levels and no symptoms would improve their lives.

Screening during Pregnancy

Because untreated hypothyroidism is a serious problem for the unborn child, all pregnant women should be tested for thyroid function. It should be noted that elevated levels of estrogen during pregnancy cause thyroid hormone levels to rise, so even if a pregnant woman has an underactive thyroid, test results for thyroxine may actually be normal. A blood test showing elevated TSH levels, however, is a reliable indicator of an underactive thyroid, even in pregnancy.

Screening in Infants

It is very difficult to diagnose hypothyroidism in newborns by symptoms alone. Fortunately, almost all newborns with hypothyroidism are identified shortly after birth through an effective national screening program using a thyroid blood test. Each year over 1,500 children are now saved from subnormal intelligence.

Ruling Out Other Disorders

The symptoms of hypothyroidism are so similar to common conditions, including just aging, it often makes diagnosis difficult.

Aging-Related Disorders. Some symptoms of hypothyroidism and aging are very similar. Menopausal symptoms often resemble hypothyroidism. Many of other problems related to aging, such as vitamin deficiencies, Parkinson's and Alzheimer's diseases, and arthritis have characteristics that can mimic hypothyroidism.

Obesity. Many people who are overweight believe that they have an underactive thyroid gland, but only a very small percentage of obese people actually have hypothyroidism. Hypothyroid patients generally show only a moderate weight increase of five to 10 pounds, mainly from accumulation of fluid, and in fact they often have a decreased appetite.

Depression. A lack of interest in personal relationships, drowsiness, an increase in sleep, slowing of speech, and general apathy are signs of clinical depression as well as hypothyroidism. The two disorders, in fact, often coexist, particularly in older women, so diagnosing one does not rule out the presence of the other.

Diseases of Muscles and Joints. Joint and muscle pain may be the first symptoms of hypothyroidism. Most likely, however, such pain is not caused by hypothyroidism if other thyroid symptoms remain absent. Numerous conditions can cause muscle and joint pain, and if thyroid levels are normal the physician should look for other causes.

Who Gets Hypothyroidism?

Age and Gender

As many as 13 million Americans have a thyroid disorder, but some studies suggest that nearly 10% of the population may have undiagnosed thyroid abnormalities, since many people have no symptoms. Mild thyroid failure occurs eventually in 4% to 21% of women and 3% to 16% of men, with the risk increasing with age. In all age groups, women have a higher risk than men, although the difference is significant only after age 34.

Women. Some experts estimate that as many as 10% of women over 50 have some indication of this condition. In fact, the symptoms of hypothyroidism and menopause are very similar and hypothyroidism may easily be missed. Pregnant women have a 2.5% to 5% incidence of postpartum thyroiditis, which develops into hypothyroidism in about 23% of cases three to five years later.

Age. The elderly are most susceptible, but hypothyroidism can affect people of all ages. For example, one out of every 4,000 infants is born with congenital hypothyroidism; female infants are at higher risk than males.

Genetic Defects

Heredity plays a role in both underactive and overactive thyroid. About half of those with close relatives with chronic autoimmune disease have antibodies to the thyroid. (Antibodies are the immune system's agents for attacking specific foreign substances, such as microbes.) Thyroid disease will often skip generations; someone with an underactive thyroid may have healthy parents but have grandparents who had thyroid troubles. Some people inherit a tendency to thyroid problems but never become ill, while others become very sick. As many as half of those with Turner's syndrome, one of the most common genetic diseases in women, have hypothyroidism, usually in the form of Hashimoto's thyroiditis.

Type 1 Diabetes and Other Autoimmune Diseases

About 10% of patients with type 1 (insulin-dependent) diabetes develop chronic thyroiditis, which in turn can lead to subclinical hypothyroidism. This condition may affect insulin requirements, so such patients should have regular examinations for hypothyroidism. Women with other autoimmune diseases, including systemic lupus erythematosus, pernicious anemia, and rheumatoid arthritis, are also at higher risk for hypothyroidism. Pregnant women with autoimmune conditions have a 25% risk for hypothyroidism during gestation.

Smoking

Smoking triples the risk for developing thyroid disease, particularly autoimmune hyper- and hypothyroidism. According to a 1998 study, smoking also increases the negative effects of hypothyroidism in patients who already have the condition. Pregnant women with subclinical hypothyroidism who smoke between one and two packs of cigarettes daily are at risk for even lower thyroid function than their nonsmoking peers. These women may also develop significantly higher levels of total cholesterol and LDL, the so-called bad cholesterol **,** than non-smoking women with subclinical hypothyroidism.

Breast Cancer

Some association exists between breast cancer and increased levels of thyroid autoantibodies, indicating that many women with breast cancer may be susceptible to hypothyroidism. (The presence of these autoantibodies, however, is a favorable indicator for survival in women who develop breast cancer.)

Other Risk Factors

Hypothyroidism occasionally occurs with Addison's disease and myasthenia gravis. It is also associated with ovarian failure, sleep apnea, premature gray hair, and left-handedness. People with anorexia or bulimia are at risk for hypothyroidism; in these cases, however, reduced thyroid function may be an adaptation to malnutrition and therefore some experts think only that the eating disorder should be treated, not hypothyroidism. Because so many drugs affect the thyroid, anyone being treated for a chronic disease, patients who are taking thyroid medication, and those who are at risk for thyroid disorder should discuss the impact these drugs on their thyroid.

How Serious Is Hypothyroidism?

Long-Term Outlook

Hypothyroidism carries serious physical and mental risks for all ages. Studies indicate that subtle adverse health effects occur even with subclinical hypothyroidism, a condition in which the patient has no symptoms but blood tests indicate hypothyroidism. Fortunately, hypothyroidism is now easily diagnosed, and treatment will restore normal thyroid function and relieve symptoms and physical signs of the disease. With treatment, a patient should expect to live a normal life, free of harmful consequences. It should be noted, however, that iodine deficiency and goiter are still major problems in less developed nations, causing varying degrees of mental retardation in millions of people.

Effects on the Heart

Thyroid hormones affect the heart directly and indirectly. Hypothyroidism is associated with unhealthy cholesterol levels, high blood pressure, and heart failure in people with existing heart disease. One 2000 study even suggested that even *subclinical* hypothyroidism increases the rates of heart disease and heart attacks in older women. In the study, this mild condition alone was believed to be responsible for 14% of heart attacks, which was only slightly less than those caused by the primary risk factors (high cholesterol, smoking, high blood pressure, and diabetes).

Cholesterol and Lipid Levels. According to one 2000 study, hypothyroidism is only second to poor dietary habits as a cause of high cholesterol. Studies have reported a higher risk for high levels of low-density lipoprotein (LDL) cholesterol (the "bad" cholesterol) and a cholesterol-carrying molecule called lipoprotein(a), both of which are major risk factors in heart disease. Treatment can significantly reduce total cholesterol, LDL, and lp(a), helping to prevent the development of coronary artery disease. Some studies report that total and LDL cholesterol levels are higher than normal even in people with subclinical hypothyroidism (TSH levels between 5.1 and 10 mU/L). Research on whether the association between mild hypothyroidism and cholesterol levels is significant are mixed, however.

Homocysteine. Recent studies are also finding that hypothyroidism is associated with elevated levels of homocysteine, an amino acid that is increasingly becoming a major suspect in heart diseases.

Blood Pressure. Hypothyroidism may slow the heart rate to less than 60 beats per minute and

reduce the heart's pumping capacity. For this reason there has been some concern about an increased risk for high blood pressure. One study found no such association, at least in older women. Another 1999 study, however, reported changes in blood vessel properties that affect blood pressure even in patients with subclinical hypothyroidism. In any case, hypothyroidism does increase the risk for high blood pressure in pregnant women, and all patients with chronic hypothyroidism should have their blood pressures checked regularly.

Other Health Effects

Hypothyroidism is also commonly associated with iron deficiency anemia and respiratory problems. Some research has associated hypothyroidism with an increased risk for glaucoma. Hypothyroidism may also worsen headaches in people predisposed to them.

Myxedema Coma

If hypothyroidism is not treated, or if drugs, infections, stress, or other traumatic situations worsen existing hypothyroidism, an emergency condition can develop with severe manifestations of myxedema, including a severe drop in body temperature (hypothermia), seizures, stupor, and finally coma.

Effects on the Mind

Depression. Depression is common in hypothyroidism and can be severe. Some psychiatrists suspect that even subclinical hypothyroidism may contribute to depression. The two disorders may have some common physiological basis. In one study, both triiodothyronine (T3) and L-tryptophan (a chemical important in depression) appeared to be taken up by red blood cells using the same carrier. Interesting implications of the study are that alterations in one substance may affect the other. Adding thyroid hormones to antidepressants, in fact, hastens a depressed patient's recovery, even in some patients who have not been diagnosed with hypothyroidism. Hypothyroidism should be considered as a possible cause of any chronic depression, particularly in older women.

Mental and Behavioral Impairment. Untreated hypothyroidism can, over time, cause mental and behavioral impairment and eventually, even dementia. Whether treatment can completely reverse problems in memory and concentration is uncertain, although many experts believe that only mental impairment in hypothyroid that occurs at birth is permanent.

Effects on Infertility and Pregnancy

Most women with hypothyroidism fail to produce eggs, and they may receive a diagnosis of hypothyroidism for the first time during a fertility evaluation. A pregnant woman with hypothyroidism is at higher risk for miscarriage. In one study, nearly 40% of women with a history of miscarriages and normal thyroid levels had antithyroid antibodies (immune factors that attack thyroid tissue). Those who remain hypothyroid near the time of delivery are in danger of developing high blood pressure and premature delivery. They are also prone to postpartum thyroiditis, which is said to be a contributor to postpartum depression.

Effects on Infants and Children

Children of Untreated Mothers. Children born to untreated women who have even mild or subclinical hypothyroidism are at risk for impaired mental performance. In one study, children between the ages of seven and nine whose mothers of had subclinical hypothyroidism during

pregnancy had IQs that were seven points lower than children with mothers without the disorder during pregnancy.

Effects of Hypothyroidism in Infancy. Infants born with congenital hypothyroidism need to receive treatment as soon as possible after birth to prevent mental retardation, stunted growth, and other aspects of abnormal development (a syndrome referred to as cretinism). It has been estimated that untreated infants can lose up to three to five IQ points per month during the first year. An early start of life-long treatment avoids or minimizes this damage. According to a 1999 Canadian study, however, children with congenital hypothyroidism who had been given early treatment still had a higher risk of learning disabilities in the third grade. By the sixth grade they had caught up in some areas, but problems in memory, attention, and spatial processing persisted into adolescence.

Transient hypothyroidism is common among premature infants. Although temporary, severe cases can cause difficulties in neurologic and mental development.

Effects of Hypothyroidism that Develops in Older Children. If hypothyroidism develops in children after two years, mental retardation is not a danger, but physical growth may be slowed and new teeth delayed. If treatment is given late, adult growth could be affected. Even with treatment, some children with severe hypothyroidism may have attention problems and hyperactivity.

Long-term Effects of Childhood X-Ray Treatments

Two million Americans, mostly children, received x-ray treatments to the head or neck between 1920 and 1960 for acne, enlarged thymus gland, recurrent tonsillitis, or chronic ear infections. The risk of developing thyroid nodules and thyroid cancers is increased in these individuals. Cancer can develop as long as 40 years after the original treatment; it is a particular risk in those treated who develop hypothyroidism. Everyone who has had head and neck radiation should be sure to have their thyroid glands examined regularly.

How Is Hypothyroidism Treated?

General Guidelines

In the nineteenth century, a few years after a relationship was observed between myxedema and surgical removal of the thyroid gland, physicians began to feed hypothyroid patients whole or powdered extracts of animal thyroid glands. This was one of the first successful medical treatments based on careful scientific observation. Although synthetic thyroid is now used most often, the therapeutic principle for hypothyroidism is the same as it was 100 years ago: to provide the body with replacement thyroid hormone when the gland is not able to produce enough itself.

Candidates for Treatment

It is clear that the following conditions warrant treatment with thyroid replacements.

Full-blown hypothyroidism with clear symptoms and blood tests that show high TSH (generally 10 mU/L and above) and low thyroxine must be treated.

Sensitive tests, however, can now diagnose hypothyroidism at earlier stages when TSH levels are slightly higher (for example between 5 mU/L and 10 mU/L) but thyroxine levels are normal and there are no obvious symptoms (subclinical hypothyroidism). Although some physicians are

uncertain about whether to treat such cases, arguments for treating this mild condition are mounting for the following reasons:

- Evidence is showing an association between subclinical hypothyroidism and unhealthy cholesterol levels, particularly if a patient also has thyroid autoantibodies.
- Studies are showing that treating hypothyroidism improves cholesterol levels.
- Subclinical hypothyroidism is also associated with adverse mental effects. Between 25% and 50% of patients with subclinical hypothyroidism feel better after taking thyroid medication even if they do not report such symptoms.

In some cases, however, thyroid levels can vary widely and measurements suggesting subclinical hypothyroidism may not persist. One approach to this is to measure free thyroxine and TSH levels over several weeks to months to determine if such levels are consistent and not temporary.

Levothyroxine

Levothyroxine is treatment of choice for hypothyroidism. This drug is a synthetic derivative of T4 (thyroxine), and it normalizes blood levels of TSH, T4, and T3. Levothyroxine is slowly assimilated by body organs, and it usually takes three to six weeks of treatment for improvement in symptoms in adults, although many patients feel better after two to three weeks of treatment. Usually early on they experience weight loss, less puffiness, and improved pulse; improvements in anemia and skin, hair, and voice tone, however, may take a few months. Other conditions, such as goiter and high LDL cholesterol levels decline even more gradually. (HDL levels, the so-called good cholesterol, are not affected by treatment.)

Brand Name Versus Generic

Levothyroxine brands available in the US and overseas include Synthroid, Unithroid, Levothroid, Levoxyl, and Euthyrox. Generic brands are also available.

Under considerable debate is the question of whether generic thyroid preparations are as effective as brand products. In the past, manufactures of levothyroxine have not had to meet as strict standards as in the production of other drugs. This has resulted in thyroid products with varying quality. The FDA now has stronger requirements, and, in fact, has recently approved Unithroid under the new guidelines. One study reported that low-cost generic thyroid preparations are as effective as and certainly less expensive than Synthroid and Levoxyl. Many expert groups, however, including the Thyroid Society, still recommend the branded preparations. They argue that in some generic brands, the amount of T4 is outside the FDA range, which can be significant. In addition brand-name products come in up to 12 different strengths, while generics have less variety from which to choose. This makes it difficult for patients whose dosages must be frequently adjusted.

Desiccated or dried powdered thyroid (Armour Thyroid, S-P-T, Thyrar, Thyroid Strong) is made from animal glands. It was once the most common form of thyroid therapy but is no longer recommended because potency varies. Some people argue that with stricter FDA regulations, this natural form is better controlled and may even reduce the risk of developing autoimmunity factors. However, studies need to be conducted to confirm this.

Appropriate Dosage Levels. Initial dosage levels are determined on an individual basis:

- Some patients can begin by taking full replacement doses of thyroid hormones. Young adults with a short history of hypothyroidism might be able to tolerate a full initial dosage.
- Most individuals, particularly older adults, need to build up gradually. In uncomplicated cases, the dose typically starts at 50 micrograms per day, which then increases and three- to four-week intervals until levels are between 100 and 150 micrograms.
- Pregnant women with hypothyroidism may require higher than normal doses.

Although the maintenance dose for most patients averages 112 micrograms, some patients fail to feel significantly better at that level. Unfortunately, higher doses suppress TSH levels to the point that there may be a higher risk for osteoporosis and heart problems. Normal thyroxine treatments do not appear to pose such risks. (One promising solution for such patients requiring TSH suppressive treatment may be a combination of a lower-dose thyroxine and triiodothyronine, the other important thyroid hormone. [*See below*.]

Daily Regimen. Because thyroid replacement is usually life-long, setting up a regular daily routine is helpful. Here are some tips to remember:

- Establishing a habit of taking the medication at the same time each day may help prevent missed doses.
- Levothyroxine is very forgiving, however. The hormone remains in the body for several days, so one missed dose should not cause a noticeable decline in well-being. The patient can safely take two doses the next day.
- Although levothyroxine can be taken at any time of day either with or without food, fiber and common daily supplements, such as calcium, may interfere with thyroxine absorption. Some experts recommend taking thyroid hormone upon awakening and at least 30 minutes before consuming anything, including breakfast or supplements.

Annual Evaluation. Thyroid failure is an ongoing process and so is its treatment. Many factors, such as changes in health or brands, require changing dosages. Experts recommend that patients be reevaluated six months after normal TSH levels have been reached and then once a year. A dose of thyroid medication that is appropriate for a patient one year may be too low the next. To maintain normal thyroid levels, some patients may need to take gradually increasing doses of thyroid hormone every year or two. If the patient changes dose levels or thyroxine brands then he or she should be checked at least six weeks following such changes.

Problems Encountered with Levothyroxine Treatment

Because levothyroxine is identical to the thyroxine the body manufactures, side effects are nearly unheard of. Over- or under-dosing, however, is fairly common, although rarely serious in the short term. [*See Table* Symptoms of Under- and Over-Dosing.]

Symptoms of Under- and Over-Dosing of Levothyroxine	
Under Dosing	**Over-Dosing**

Sluggishness	Heart symptoms (Rapid heart beat, palpitations, and wide variations in pulse. Possible angina.
Mental dullness	Agitation (tremor, nervousness, insomnia, excessive sweating)
Feeling cold	Pain (Headache and muscle pain)
Muscle cramps	Intestinal and metabolic symptoms (Change in appetite, diarrhea, weight loss)
	Fever and intolerance to heat

Effects of Underdosing. If the levothyroxine dose is not sufficient to restore normal thyroid levels, or if the patient frequently forgets to take the medication, the patient may continue to experience symptoms of hypothyroidism. [*See Table* Symptoms of Under- and Over-Dosing.] Even mild hypothyroidism without any symptoms can eventually lead to an increase in cholesterol levels. In one 2000 study, 40% of people taking thyroid medication still had abnormal levels of TSH. To avoid these problems, patients should take the proper dosage of levothyroxine as prescribed and have regular check-ups that include measurement of blood TSH.

Effects of Overdosing: Thyrotoxicosis. Overdosing can cause thyrotoxicosis, the symptoms of *hyper*thyroidism. [*See Table* Symptoms of Under- and Over-Dosing.] A patient with too much thyroid hormone in the blood is at an increased risk for abnormal heart rhythms, rapid heartbeat, and possibly a heart attack if the patient has underlying heart disease. Excess thyroid hormone is particularly dangerous in newborns, and their drug levels must be carefully monitored to avoid brain damage.

Effects of Long-Term Treatment. Patients with hypothyroidism usually receive life-long levothyroxine therapy. Patients without symptoms should be monitored regularly for signs of hypothyroidism. Although studies indicate that postmenopausal women who are taking long-term normal replacement thyroxine have no out-of-the-ordinary risk for osteoporosis, such women should consider estrogen replacement therapy if they have no contraindications to it. One study published in 2000, for example, found no higher risk for osteoporosis in women taking thyroxine. There was, however, an association between a slightly higher risk of fractures and taking the hormone. This may be due to a higher incidence of corticosteroid treatments in women taking thyroxine, but more research is needed.

Effects of Suppressive Thyroid Therap y. Suppressive thyroid therapy is treatment that is high enough to block the production of natural TSH but too low to cause hyperthyroid symptoms. Often patients being given suppressive treatment have thyroid cancer or need to have thyroid nodules reduced.

Studies have shown that postmenopausal women taking suppressive thyroid therapy are at risk for accelerated osteoporosis, a disease that reduces bone mass and increases risk of fractures. (Some researchers suggest, however, that such bone loss does not significantly increase the danger for fracture and the cholesterol-lowering benefits of suppressive therapy outweigh this small risk.)

In any case, bone density loss can be reduced or avoided by taking no higher a dose of thyroxine than necessary to restore normal thyroid function. A number of medications are also available that can help preserve bone. [See *Menopause, Estrogen Loss, and Their Treatments*.] (*Premenopausal* women or men taking suppressive therapy do not appear to have the same risk for osteoporosis, although more research is needed to confirm this.)

If drug levels remain fixed in suppressive thyroid therapy, adverse effects on the heart and impaired exercise tolerance can result. Continuous, careful tailoring of T4 doses can reduce or prevent these effects.

Drug Interactions with Levothyroxine. Many substances and conditions interact with levothyroxine, however, which may either enhance or interfere with absorption. Large amounts of dietary fiber may also reduce its action. People whose diets are consistently high in fiber may require larger doses of the drug. Since thyroid hormones regulate the metabolism and can affect the actions of a number of medications, dosages may need to be adjusted if a patient is being treated for other conditions. Even changing thyroxine brands can have a different effect. [*See Table.*]

Examples of Drug Interactions with Thyroid Hormone			
Drugs that Inhibit Thyroid Hormone (Keep at least two hours difference between taking thyroid and other drugs or supplements.)	Drugs that are Enhanced by Thyroid Hormones	Drugs that are Suppressed by Thyroid Hormone	**Drugs that Reduce Thyroid Levels**
Iron supplements, even in multivitamins.	Thyroid hormone may increase risk of serious side effects in heart disease patients given epinephrine (adrenaline) injections.	Diabetic patients taking thyroid hormone may need additional insulin or oral hypoglycemic drugs. Stopping or reducing thyroid hormone may increase risk of hypoglycemia.	Lithium, a drug widely used to treat psychiatric disorders, has multiple effects on thyroid hormone synthesis and secretion.
Aluminum-containing antacids, such as Maalox.	Warfarin, a blood thinner, is enhanced by thyroid hormone and reduced doses of this medication may be needed if thyroid treatment is started after blood thinning	Patients with heart disease may need to increase their dosage of digoxin (Lanoxin).	Amiodarone (Cordarone), which is used to treat abnormal heart rhythms, contains iodine and can induce hyper- or hypothyroidism, particularly in patients

	treatments have begun.		with an existing thyroid problem.
Estrogens and oral contraceptives (usually inhibits thyroid hormone only in people with non-functioning thyroid gland).	Many antidepressants (in some cases, potency of both antidepressants and thyroid hormones may increase).		Antiseizure Agents . Drugs used for epilepsy, including phenytoin and carbamazepine, reduce thyroid levels.
Sucralfate (Carafate)			Large doses of selenium, a common over-the-counter supplement.
Drugs used to decrease cholesterol levels by binding bile acids, such as colestipol (Colestid) and cholestyramine (Questran). Keep a four to five hours difference between cholesterol and thyroid drugs.			Some drugs used in chemotherapy.
Calcium carbonate supplements			

Triiodothyronine and Levothyroxine Combination

Triiodothyronine (T3), the other important thyroid hormone, is not ordinarily prescribed except under special circumstances. Most patients respond well to thyroxine alone, and the use of T3 may cause disturbances in heart rhythms. Some patients treated only with thyroxine, however, do not feel completely well. In one study, patients were given a regimen that combined liothyronine (Cytomel, Triostat), a synthetic form of triiodothyronine, and a slightly lower-than-normal dose of levothyroxine. Patients given the combination treatment reported a better mood and experienced fewer adverse physical symptoms. These improvements occurred without suppressing TSH, a risk factor for osteoporosis. The study was small, however, and patients were severely hypothyroid and may have been lacking T3 in the first place. The study also was only ten weeks long. More work is needed before this combination is recommended widely.

Vitamin B

People with hypothyroidism have higher than normal levels of homocysteine, an amino acid that is a suspected risk factor for heart disease. Vitamins B6, B12, and folic acid (another vitamin B) are important in protecting against elevated blood levels. Supplements, then, may be important companions to thyroid replacement in restoring normal homocysteine levels.

Treatment of Special Cases

Treating the Elderly and Patients with Heart Disease. Elderly patients and those with heart conditions usually start with lower doses, since a large initial dose may be a shock to the heart, and about 40% of patients who have heart disease must take a lower-than-average maintenance doses. Thyroid treatment may aggravate angina in about one-fifth of patients with the heart condition. The hormone has no effect and may even improve angina in the remaining four fifths.

Treating Newborns and Infants with Hypothyroidism. Newborns with congenital hypothyroid should be treated as soon as possible to prevent mental deficiency, poor growth, and abnormal development. Treating the infant after about a month and a half does not reverse any existing mental impairment, although it does reverse physical damage. Some experts urge treating newborns within two weeks of birth and at slightly higher than recommended doses, although evidence is lacking to confirm these recommendations. Single oral doses of levothyroxine can usually restore normal thyroid hormone levels within one to two weeks. Infants should be monitored closely to be sure that thyroxine levels are as consistently close to normal as possible. These children need to continue life-long thyroid hormone treatments.

One study suggested that breast-fed babies with congenital hypothyroidism may test slightly better later on than bottle-fed infants. Soy-based formulas can reduce the intestinal absorption of thyroxine. If soy formula is introduced, the hormone dose should be increased, and when the formula is discontinued the thyroid dose should be reduced.

Treatment during Pregnancy and for Postpartum Thyroiditis. Women who have hypothyroidism before becoming pregnant may need to increase their dose of levothyroxine by up to 50%. In very rare cases, women may develop hypothyroidism during pregnancy and need to be treated with levothyroxine in full replacement doses to reduce the risk of stillbirth. The developing baby is not affected when the pregnant woman takes thyroid hormones. The pregnant woman with hypothyroidism should be monitored regularly and doses adjusted as necessary. If postpartum thyroiditis develops after delivery, any thyroid medication should be reduced or temporarily stopped during this period.

Treatment for Myxedema Coma. Myxedema coma is an emergency situation and the patient should be given intravenous doses of thyroid hormone, which could be triiodothyronine, levothyroxine, or both. Lower doses may be safer in elderly patients. Often, hydrocortisone, a corticosteroid, is also administered. Any other accompanying critical conditions, including low body temperature, slow heart rate, low blood sugar, and difficulty in breathing, should also be treated immediately.

Treatment of Secondary Hypothyroidism. The small percentage of patients who have hypothyroidism due to a pituitary or hypothalamus problem should take levothyroxine along with their other medication to treat the primary disorder. In secondary hypothyroidism, the adrenal gland is often impaired. This means that the increased activity in the metabolic rate that occurs after thyroid replacement therapy may trigger a severe and even life-threatening condition called addisonian crisis, which is caused by a sudden demand for the depleted stress hormones secreted by the adrenal gland. Before administering thyroid replacement, then, the physician should initiate a test that stimulates release of ACTH, one of the hormones secreted by the adrenal gland. If there is insufficient ACTH, then before thyroid replacement is started, the patient is usually treated with cortisone acetate, a stress hormone.

Taking Thyroid Hormone Inappropriately

In one study of those taking thyroid hormone, 12% of women and 29% of men were taking it inappropriately. In some cases of infertility, women with menstrual problems and repeated miscarriages and men with low sperm counts have been treated with thyroid hormones even where there was no evidence of thyroid abnormalities. (Women showing high levels of TSH, however, may benefit from levothyroxine therapy.) Other inappropriate uses for thyroid hormones

are for weight loss and to reduce high cholesterol levels. Thyroid hormones have also been given to treat so-called metabolic insufficiency. Vague symptoms suggesting low metabolism, such as dry skin, fatigue, slight anemia, constipation, depression, and apathy, should not be treated indiscriminately with thyroid hormone. No evidence exists that thyroid therapy is beneficial unless the patient has proven hypothyroidism. Use of thyroid hormones can weaken muscles and over the long term, even heart muscles. One exception is the use of thyroxine to enhance drugs used for the treatment of severe depression.

Where Else Can Information About Hypothyroidism Be Obtained

The Thyroid Society, 7515 South Main Street, Suite 545, Houston, TX 77030. Call 1-800-THYROID or (713-799-9909) or on the Internet (http://www.the-thyroid-society.org).
The society offers excellent in-depth information. They also have local listings of physicians well versed in thyroid disease.

Thyroid Foundation of America, Inc., Ruth Sleeper Hall-RSL350, 40 Parkman St, Boston, MA 02114. Call (800-832-8321) or on the Internet (http://www.tsh.org/).
The foundation provides local listings of physicians qualified to treat thyroid disorders and will send an information package.

The Endocrine Society, 4350 East West Hwy, Ste 500, Bethesda, MD 20814-4110. Call 301-941-0200 or on the Internet (http://www.endo-society.org/).
The society provides one-page fact sheets on thyroid and other endocrine disorders.

American Thyroid Association, Townhouse Office Park, 55 Old Nyack Turnpike, Suite 611, Nanuet, NY, 10954. Call 800-542-6687 or on the Internet (http://www.thyroid.org/).
The association will provide information about common thyroid diseases, including a booklet on both hypothyroidism and hyperthyroidism. The association will also provide local listings of physicians who have an interest and experience in treating patients with thyroid disease.

Thyroid Foundation of Canada, 96 Mack Street, Kingston, Ontario K7L 1N9. Call (513-544-8364) or In Canada: (800-267-8822), on the Internet (http://www.io.org/~thyroid/English/Guides.html)

American Association of Clinical Endocrinologists, 1000 Riverside Ave., Ste 205, Jacksonville FL 32204. Call (904-353-7878) or on the Internet (http://aace.com). Web site provides names of local endocrinologists.

Good Internet Site on Thyroid

http://www.thyroid.com/

Find an Endocrinologist at http://aace.com/serv/searchindex.htm

Special Instructions: