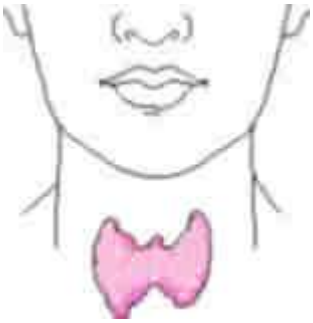
Your Thyroid



The thyroid gland is the biggest gland in the neck. It is situated in the anterior (front) neck below the skin and muscle layers. The thyroid gland takes the shape of a butterfly with the two wings being represented by the left and right thyroid lobes which wrap around the trachea. The sole function of the thyroid is to make thyroid hormone. This hormone has an effect on nearly all tissues of the body where it increases cellular activity. **The function of the thyroid therefore is to regulate the body's metabolism.**

Common Thyroid Problems

The thyroid gland is prone to several very distinct problems, some of which are extremely common. These problems can be broken down into [1] those concerning the production of hormone (too much, or too little), [2] those due to increased growth of the thyroid causing compression of important neck structures or simply appearing as a mass in the neck, [3] the formation of nodules or lumps within the thyroid which are worrisome for the presence of thyroid cancer, and [4] those which are cancerous. Each thyroid topic is addressed separately and illustrated with actual patient x-rays and pictures to make them easier to understand. The information on this web site is arranged to give you more detailed and complex information as you read further.

- ***Goiters*** ~ A thyroid goiter is a dramatic enlargement of the thyroid gland. Goiters are often removed because of cosmetic reasons or, more commonly, because they compress other vital structures of the neck including the trachea and the esophagus making breathing and swallowing difficult. Sometimes goiters will actually grow into the chest where they can cause trouble as well. Several nice x-rays will help explain all types of thyroid goiter problems.

- ***Thyroid Cancer*** ~ Thyroid cancer is a fairly common malignancy, however, the vast majority have excellent long term survival. We now include a separate page

on the characteristics of each type of thyroid cancer and its typical treatment, follow-up, and prognosis. Over 30 pages thyroid cancer.

- ***Solitary Thyroid Nodules*** ~ There are several characteristics of solitary nodules of the thyroid which make them suspicious for malignancy. Although as many as 50% of the population will have a nodule somewhere in their thyroid, the overwhelming majority of these are benign. Occasionally, thyroid nodules can take on characteristics of malignancy and require either a needle biopsy or surgical excision. Now includes risks of radiation exposure and the role of Needle Biopsy for evaluating a thyroid nodule. Also a new page on the role of ultrasound in diagnosing thyroid nodules and masses.

- ***Hyperthyroidism*** ~ Hyperthyroidism means too much thyroid hormone. Current methods used for treating a hyperthyroid patient are radioactive iodine, anti-thyroid drugs, or surgery. Each method has advantages and disadvantages and is selected for individual patients. Many times the situation will suggest that all three methods are appropriate, while other circumstances will dictate a single best therapeutic option. Surgery is the least common treatment selected for hyperthyroidism. The different causes of hyperthyroidism are covered in detail.

- ***Hypothyroidism*** ~ Hypothyroidism means too little thyroid hormone and is a common problem. In fact, hypothyroidism is often present for a number of years before it is recognized and treated. There are several common causes, each of which are covered in detail. Hypothyroidism can even be associated with pregnancy. Treatment for all types of hypothyroidism is usually straightforward.

- ***Thyroiditis*** ~ Thyroiditis is an inflammatory process ongoing within the thyroid gland. Thyroiditis can present with a number of symptoms such as fever and pain, but it can also present as subtle findings of hypo or hyper-thyroidism. There are a number of causes, some more common than others. Each is covered on this site.

Search Endocrine Web for any thyroid topic.
Over 100 pages on thyroid diseases. New pages and/or illustrations added weekly.

How Thyroid Hormone is Produced, and how production is regulated

Thyroid Cancer Overview, more detailed information available from here.

Surgical Treatment of Thyroid Problems

More about Thyroid Nodules

The use of Ultrasound to Examine the Thyroid

Characteristics of Benign and Malignant Thyroid Nodules and when to biopsy them

More about Goiters

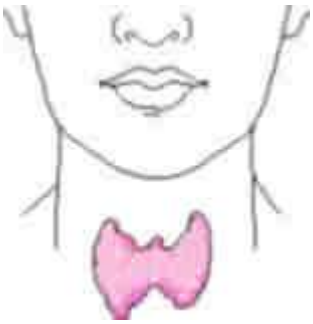
More about goiters which grow under the Sternum and into the chest

A close look at all the Laboratory and X-ray Tests used to evaluate thyroid diseases

Hyperthyroidism...the problems and treatments of too much thyroid hormone production

Hypothyroidism...too little thyroid hormone and its associated problems

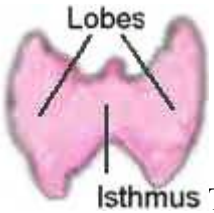
Thyroid diseases associated with Pregnancy



How Your Thyroid Works

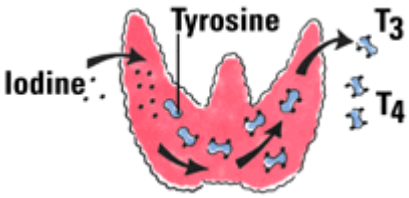
"A delicate Feedback Mechanism"

Your thyroid gland is a small gland, normally weighing less than one ounce, located in the front of the neck. It is made up of two halves, called lobes, that lie along the windpipe (trachea) and are joined together by a narrow band of thyroid tissue, known as the isthmus.

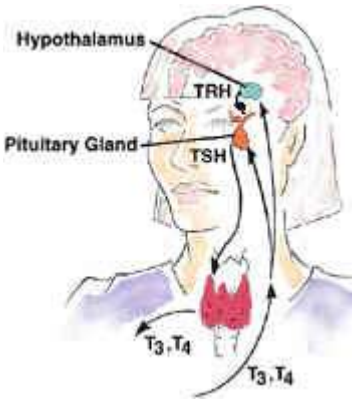


The thyroid is situated just below your "Adams apple" or larynx. During development (inside the womb) the thyroid gland originates in the back of the tongue, but

it normally migrates to the front of the neck before birth. Sometimes it fails to migrate properly and is located high in the neck or even in the back of the tongue (lingual thyroid) This is very rare. At other times it may migrate too far and ends up in the chest (this is also rare).

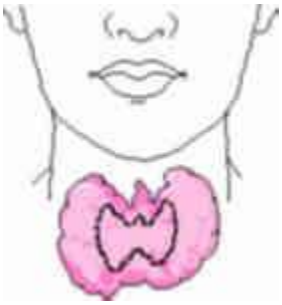


The function of the thyroid gland is to take iodine, found in many foods, and convert it into thyroid hormones: thyroxine (T4) and triiodothyronine (T3). Thyroid cells are the only cells in the body which can absorb iodine. These cells combine iodine and the amino acid **tyrosine** to make T3 and T4. T3 and T4 are then released into the blood stream and are transported throughout the body where they control metabolism (conversion of oxygen and calories to energy). **Every cell in the body depends upon thyroid hormones for regulation of their metabolism.** The normal thyroid gland produces about 80% T4 and about 20% T3, however, T3 possesses about four times the hormone "strength" as T4.



The thyroid gland is under the control of the pituitary gland, a small gland the size of a peanut at the base of the brain (shown here in orange). When the level of thyroid hormones (T3 & T4) drops too low, the pituitary gland produces **Thyroid Stimulating Hormone (TSH)** which stimulates the thyroid gland to produce more hormones. Under the influence of TSH, the thyroid will manufacture and secrete T3 and T4 thereby raising their blood levels. The pituitary senses this and responds by decreasing its TSH production. One can imagine the thyroid gland as a furnace and the pituitary gland as the thermostat. Thyroid hormones are like heat. When the heat gets back to the thermostat, it turns the thermostat off. As the room cools (the thyroid hormone levels drop), the thermostat turns back on (TSH increases) and the furnace produces more heat (thyroid hormones).

The pituitary gland itself is regulated by another gland, known as the hypothalamus (shown in our picture in light blue). The hypothalamus is part of the brain and produces **TSH Releasing Hormone (TRH)** which tells the pituitary gland to stimulate the thyroid gland (release TSH). One might imagine the hypothalamus as the person who regulates the thermostat since it tells the pituitary gland at what level the thyroid should be set.



Thyroid Goiter

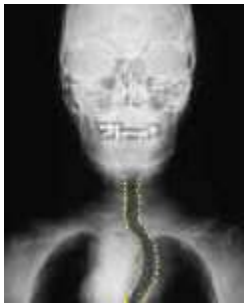
Enlargement of the thyroid

The term nontoxic goiter refers to enlargement of the thyroid which is not associated with overproduction of thyroid hormone or malignancy. The thyroid can become very large so that it can easily be seen as a mass in the neck. This picture depicts the outline of a normal size thyroid in black and the greatly enlarged goiter in pink. There are a number of factors which may cause the thyroid to become enlarged. A diet deficient in iodine can cause a goiter but this is rarely the cause because of the readily available iodine in our diets. A more common cause of goiter in America is an increase in thyroid stimulating hormone (TSH) in response to a defect in normal hormone synthesis within the thyroid gland. The thyroid stimulating hormone comes from the pituitary and causes the thyroid to enlarge. This enlargement usually takes many years to become manifest.

This picture depicts the typical appearance of a goiter in a middle aged woman. Note how her entire neck looks swollen because of the large thyroid. This mass will compress the trachea (windpipe) and esophagus (swallowing tube) leading to symptoms such as coughing, waking up from sleep feeling like you cant breath, and the sensation that food is getting stuck in the upper throat. Once a goiter gets this big, surgical removal is the only means to relieve the symptoms. Yes, sometimes they can get a lot bigger than this!

INDICATIONS FOR TREATMENT

Most small to moderate sized goiters can be treated by providing thyroid hormone in the form of a pill. By supplying thyroid hormone in this fashion, the pituitary will make less TSH which should result in stabilization in size of the gland. This technique often will not cause the size of the goiter to decrease but will usually keep it from growing any larger. Patients who do not respond to thyroid hormone therapy are often referred for surgery if it continues to grow.



A more common indication for surgical removal of an enlarged thyroid [goiter] is to remove those glands which are enlarged enough to cause compression on other structures in the neck such as the trachea and esophagus. These patients will typically complain of a cough, a slight change in voice, or nighttime choking episodes because of the way that the gland compresses the trachea while sleeping. This X-ray shows how an enlarged right lobe of the thyroid has moved the trachea to the patient's left. The trachea (outlined in light yellow) should be straight from the mouth down to the lungs, but in this patient it is compressed and displaced far to the left. The enlarged gland can even compress the blood vessels of the neck which are also an indication for its removal. More about this on our page examining sub-sternal thyroids.

As always, **suspicion of malignancy** in an enlarged thyroid is an indication for removal of the thyroid. There is often a dominant nodule within a multinodular goiter which can cause concern for cancer. It should be remembered that the incidence of malignancy within a multinodular goiter is usually significantly less than 5%. If the nodule is cold on thyroid scanning, then it may be slightly higher than this. For the vast majority of patients, surgical removal of a goiter for fear of cancer is not warranted.

Another reason (although not a very common one) to remove a goiter is for cosmetic reasons. Often a goiter gets large enough that it can be seen as a mass in the neck. When other people begin to notice the mass, it is usually big enough to begin causing compression of other vital neck structures...but not always. Sometimes the large goiter causes no symptoms other than being a cosmetic problem. Realizing of course, if its big enough to be seen by your neighbors, something needs to be done...medications or surgery or it will most likely continue to get bigger.

Thyroid Cancer

Updated January 22, 2005

There are over 11,000 new cases of thyroid cancer each year in the United States. Females are more likely to have thyroid cancer at a ratio of three to one. Thyroid cancer

can occur in any age group, although it is most common after age 30 and its aggressiveness increases significantly in older patients. The majority of patients present with a nodule on their thyroid which typically does not cause symptoms.

Occasionally, symptoms such as hoarseness, neck pain, and enlarged lymph nodes do occur. Although as much as 10 % of the population will have thyroid nodules, the vast majority are benign. Only approximately 5% of all thyroid nodules are malignant. A nodule which is cold on scan (shown in photo outlined in red and yellow) is more likely to be malignant, nevertheless, the majority of these are benign as well. A lot of information about thyroid nodules and the potential of these nodules to be malignant is contained on 3 pages about nodules

Basic facts about thyroid nodules

Simply put, thyroid nodules are lumps which commonly arise within an otherwise normal thyroid gland. Often these abnormal growths of thyroid tissue are located at the edge of the thyroid gland so they can be felt as a lump in the throat. When they are large or when they occur in very thin individuals, they can even sometimes be seen as a lump in the front of the neck. The following is a list of facts regarding thyroid nodules:

- One in 12 to 15 women has a thyroid nodule
- One in 40 to 50 men has a thyroid nodule
- More than 90 percent of all thyroid nodules are benign (non-cancerous growths)
- Some are actually cysts which are filled with fluid rather than thyroid tissue

Three questions that should be answered about all thyroid nodules:

1. **Is the nodule one of the few that are cancerous ?**
2. **Is the nodule causing trouble by pressing on other structures in the neck ?**
3. **Is the nodule making too much thyroid hormone ?**

After an appropriate work-up, most thyroid nodules will yield an answer of **NO** to all of the above questions. In this most common situation, there is a small to moderate sized nodule which is simply an overgrowth of "normal" thyroid tissue, or even a sign that there is too little hormone being produced. Patients with a diffusely enlarged thyroid (called a **goiter**) will present with what is perceived at first to be a nodule, but later found to be only one of many benign enlarged growths within the thyroid (a goiter). Usually a

fine needle aspiration biopsy (FNA) will tell if the nodule is cancerous or benign. This one test can get right to the bottom of the issue (covered in detail on another page). Often an **Ultrasound** examination is necessary to determine the characteristics of a thyroid nodule (ultrasound is covered in detail on another page)

Smart Info!

✔*If any of the above questions are answered YES, then medical or surgical treatment is required.*✔

★Symptoms of thyroid nodules

Most thyroid nodules cause no symptoms at all. They are usually found by patients who feel a lump in their throat or see it in the mirror. Occasionally, a family member or friend will notice a strange lump in the neck of someone with a thyroid nodule. Another common way in which thyroid nodules are found is during a routine examination by a physician.

Occasionally, nodules may cause pain, and even rarer still are those patients who complain of difficulty swallowing when a nodule is large enough and positioned in such a way that it impedes the normal passage of food through the esophagus (which lies behind the trachea and thyroid).

★I have a nodule !! What do I do ??

First of all, remember that the vast majority of thyroid nodules are benign. Next, the nodule should be evaluated by a physician who is comfortable with this problem. **Endocrinologists and Endocrine Surgeons** deal with these problems on a regular basis, but many family practice physicians, general internists, and general surgeons are also adept at addressing thyroid nodules. This is covered in more detail on our nodule exam/biopsy page.

One of the first things that a physician will do will be to ask a number of important questions regarding your health and potential thyroid problems. These questions include whether or not you have been exposed to nuclear radiation or received radiation treatments as a child or teenager.

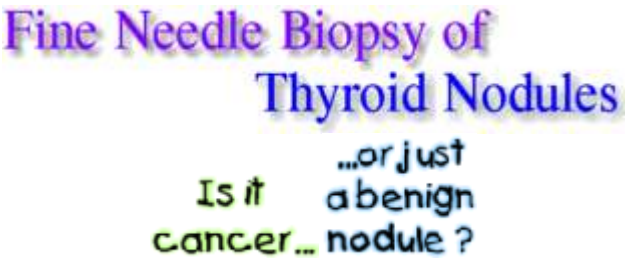
★What about radiation exposure ??

Ionizing radiation has been known for a number of years to be associated with a SMALL increased risk of developing thyroid cancer. The risk is very small and the amount of radiation exposure is usually quite high. There is typically a delay of 20 years or more between radiation exposure and the development of thyroid cancer.

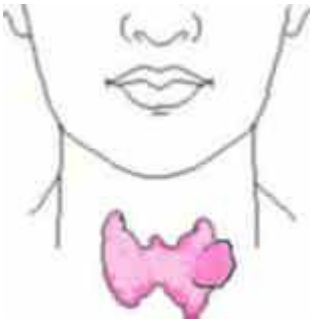
Radiation was used occasionally between the 1920's and 1950's to treat certain neck

infections such as recurrent tonsillitis as well as certain skin conditions such as severe acne.

In July, 1997 the U.S. government announced the results of a scientific study to determine if the nuclear weapons testing in the Southeast U.S. from 1945 through the 1970's would have an effect on the development of thyroid cancer in Americans. This epidemiological study determined that these nuclear tests would likely increase the amount of **thyroid cancers** seen in Americans over the next several decades. The risks are substantially greater for those patients living nearby the test sites for many years. If there is any good news to this report, it is that these cancers will typically be of the well differentiated type which have an excellent prognosis...the vast majority of these can be cured. There is NO evidence that children are at increased risk of developing thyroid cancer, the small increase risk appears to be limited to those that were directly exposed in the past. Despite these increased risks, thyroid cancer is still relatively uncommon and usually very curable.



This page is written assuming you have read the introductory page on thyroid nodules first. If you have not, please do so because it will make this page easier to understand.



Thyroid nodules increase with age and are present in almost ten percent of the adult population. Autopsy studies reveal the presence of thyroid nodules in 50 percent of the population, so they are fairly common. **Ninety-five percent of solitary thyroid nodules are benign**, and therefore, only five percent of thyroid nodules are malignant. Common types of the benign thyroid nodules are adenomas (overgrowths of "normal" thyroid tissue), thyroid cysts, and Hashimoto's thyroiditis. Uncommon types of benign thyroid nodules are due to subacute thyroiditis, painless thyroiditis, unilateral lobe agenesis, or Riedel's struma. As noted on previous pages, those few nodules which are cancerous are usually due to the most common types of **thyroid cancers** which are the differentiated" thyroid cancers. Papillary carcinoma accounts for 60 percent, follicular carcinoma accounts for 12 percent, and the follicular variant of papillary carcinoma accounting for six percent. These well differentiated thyroid cancers are usually curable, but they must be found first. ***Fine needle biopsy is a safe, effective, and easy way to determine if a nodule is cancerous.***

Thyroid cancers typically present as a dominant solitary thyroid nodule which can be felt by the patient or even seen as a lump in the neck by his/her family and friends. This is illustrated in the picture above. As pointed out on our page introducing thyroid nodules, we must differentiate benign nodules from cancerous solitary thyroid nodules. While history, examination by a physician, laboratory tests, ultrasound, and thyroid scans (shown in the picture below) can all provide information regarding a solitary thyroid nodule, the only test which can differentiate benign from cancerous thyroid nodules is a biopsy (the term biopsy means to obtain a sample of the tissue and examine it under the microscope to see if the cells have taken on the characteristics of cancer cells). Thyroid cancer is no different in this situation from all other tissues of the body...the only way to see if something is cancerous is to biopsy it. However, thyroid tissues are easily accessible to needles, so rather than operating to remove a chunk of tissue with a knife, we can stick a very small needle into it and remove cells for microscopic examination. This method of biopsy is called a **fine needle aspiration biopsy, or "FNA".**

What is a cold nodule? Thyroid cells absorb iodine so they can make thyroid hormone out of it. When radioactive iodine is given, a butterfly image will be obtained on x-ray film showing the outline of the thyroid. If a nodule is composed of cells which do not make thyroid hormone (don't absorb iodine) then it will appear "cold" on the x-ray film. A nodule which is producing too much hormone will show up darker and is called "hot". [A hot nodule is shown on our page describing the causes of hyperthyroidism].

✔The evaluation of a solitary thyroid nodule should always include history and

examination by a physician. Certain aspects of the history and physical exam will suggest a benign or malignant condition. Remember, a biopsy of some sort is the only way to tell for sure.

The following features favor a benign thyroid nodule:

- family history of Hashimoto's thyroiditis
- family history of benign thyroid nodule or goiter
- symptoms of hyperthyroidism or hypothyroidism
- pain or tenderness associated with a nodule
- a soft, smooth, mobile nodule
- multinodular goiter without a predominant nodule (lots of nodules, not one main nodule)
- "warm" nodule on thyroid scan (produces normal amount of hormone)
- simple cyst on ultrasound

The following features increase the suspicion of a malignant nodule:

- age less than 20
- age greater than 70
- male gender
- new onset of swallowing difficulties
- new onset of hoarseness
- history of external neck irradiation during childhood
- firm, irregular and fixed nodule
- presence of cervical lymphadenopathy (swollen hard lymph nodes in the neck)
- previous history of thyroid cancer
- nodule that is "cold" on scan (shown in picture above, meaning the nodule does not make hormone)
- solid or complex on ultrasound

- **Thyroid hormone levels** are usually **normal** in the presence of a nodule, and normal thyroid hormone levels do not differentiate benign from cancerous nodules. However, the presence of hyperthyroidism or hypothyroidism favors a benign nodule (thats why a "warm" nodule or a "hot" nodule favors a benign condition). Thyroglobulin levels are useful tumor markers once the diagnosis of malignancy has been made, but are nonspecific in regard to differentiating a benign from a cancerous thyroid nodule.
Ultrasound accurately determines thyroid gland volume, number and size of nodules;

separates thyroid from nonthyroidal masses; helps guide fine needle biopsy when necessary; and can identify solid nodules as small as 3 mm and cystic nodules as small as 2 mm. Although several ultrasound features favor the presence of a benign nodule, and other ultrasound features favor the presence of a cancerous nodule. Ultrasound alone cannot be used to differentiate benign from malignant nodules. This is covered more completely on our nodule/ultrasound page. And since 15 percent of cystic thyroid nodules are malignant, ultrasound determination that a nodule is cystic does not rule out thyroid cancer.

Nodules detected by **thyroid scans** are classified as **cold, hot or warm**. Eighty-five percent of thyroid nodules are cold, 10 percent are warm, and five percent are hot. *An excellent example of a cold scan is shown above*, but remember that 85 percent of cold nodules are benign, 90 percent of warm nodules are benign, and 95 percent of hot nodules are benign. [got all that???] Although thyroid scanning can give a probability that a nodule is benign or malignant, it cannot truly differentiate benign or malignant nodules and usually should not be used as the only basis for recommending treatment of the nodule, including thyroid surgery.

✔**Thyroid fine needle aspiration (FNA) biopsy is the only non-surgical method which can differentiate malignant and benign nodules** in most, but not all, cases. The needle is placed into the nodule several times and cells are aspirated into a syringe. The cells are placed on a microscope slide, stained, and examined by a pathologist. The nodule is then classified as **nondiagnostic, benign, suspicious or malignant**.

- **Nondiagnostic** indicates that there are an insufficient number of thyroid cells in the aspirate and no diagnosis is possible. A nondiagnostic aspirate should be repeated, as a diagnostic aspirate will be obtained approximately 50 percent of the time when the aspirate is repeated. Overall, five to 10 percent of biopsies are nondiagnostic, and the patient should then undergo either an ultrasound or a thyroid scan for further evaluation.

- **Benign** thyroid aspirations are the most common (as we would suspect since most nodules are benign) and consist of benign follicular epithelium with a variable amount of thyroid hormone protein (colloid).

- **Malignant** thyroid aspirations can diagnose the following thyroid cancer types: papillary, follicular variant of papillary, medullary, anaplastic, thyroid lymphoma, and metastases to the thyroid. Follicular carcinoma and Hurthle cell carcinoma cannot be diagnosed by FNA biopsy. This is an important point. Since benign follicular adenomas cannot be differentiated from follicular cancer (~12% of all

thyroid cancers) these patients often end up needing a formal surgical biopsy, which usually entails removal of the thyroid lobe which harbors the nodule.

- **Suspicious** cytologies make up approximately 10 percent of FNA's. The thyroid cells on these aspirates are neither clearly benign nor malignant. Twenty five percent of suspicious lesions are found to be malignant when these patients undergo thyroid surgery. These are usually follicular or Hurthle cell cancers. Therefore, surgery is recommended for the treatment of thyroid nodules from which a suspicious aspiration has been obtained.

✔**FNA is the first, and in the vast majority of cases, the only test required for the evaluation of a solitary thyroid nodule.** (A TSH value should also be obtained to evaluate thyroid function.) Thyroid ultrasound and thyroid scans are usually not required for evaluation of a solitary thyroid nodule. FNA has reduced the cost for evaluation and treatment of thyroid nodules, and has improved yield of cancer found at thyroid surgery. Although a solitary thyroid nodule can enlarge or shrink over time, the natural history of solitary nodules reveals that most nodules change little with time.

Can I make the nodule go away by taking thyroid hormone (can we suppress it) ??

Several studies reveal that suppression with thyroid hormone does **not** decrease the size of thyroid nodules. Therefore, unless a nodule is growing or becoming symptomatic, ***it is not necessary to suppress the nodule***. In addition, suppression of a thyroid nodule would require *long-term* TSH suppression, potentially increasing the risk of osteoporosis in these patients. While there has been a traditional distinction between thyroid glands with a solitary nodule and multinodular goiters, it has been shown that approximately 50 percent of patients with a solitary nodule on exam will have additional nodules on thyroid ultrasound. Therefore, the differentiation between solitary nodules and multinodular goiters is becoming less clear-cut. It has also been believed for many years that the presence of a multinodular goiter reduces the likelihood that a thyroid cancer is present, yet recent studies indicate that there might be an equal likelihood for developing thyroid cancer in a multinodular goiter just as in a solitary thyroid nodule. If a multinodular goiter has a predominant nodule, the predominant nodule should be biopsied.

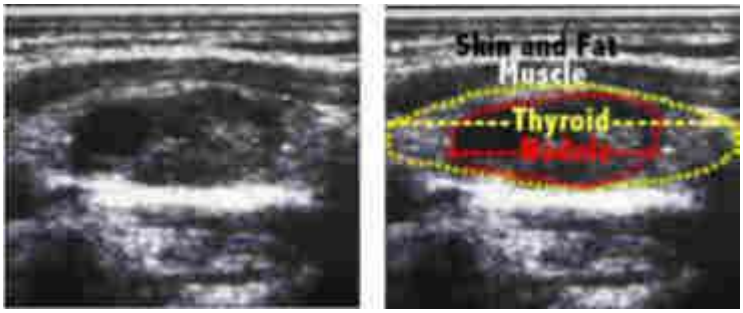
In conclusion, FNA of the thyroid is a safe, inexpensive and effective way to distinguish a benign from a malignant nodule and usually should be the first diagnostic test performed.

Once a thyroid nodule has been detected (or suspected), there are a few things that the physician wants to know before any recommendations can be made regarding what actions to take. Remember, the vast majority of thyroid nodules are benign and nothing to worry about, so the focus is on determining which ones have any reasonable chance of being cancerous. It is those few worrisome nodules which will need to be operated upon with that portion of the thyroid removed.

One of the first tests which is routinely performed is the Fine Needle Aspiration Biopsy. The FNA will usually (but not always) tell if a nodule is benign or malignant. Often this is the only test which is needed. The use of FNA and a lot more information about the potential for a thyroid nodule to be malignant is on another page. NEW!

Another test which is routinely performed is the **ultrasound.** This simple test uses sound waves to image the thyroid. The sound waves are emitted from a small hand-held transducer which is passed over the thyroid. A lubricant jelly is placed on the skin so that the sound waves transmit easier through the skin and into the thyroid and surrounding structures. This test is quick, accurate, cheap, painless, and completely safe. It usually takes only about 10 minutes and the results can be known almost immediately. Not all nodules need this test, but it is almost routine.

Do I need this test ?



This is an ultrasound of a typical thyroid nodule...except that this nodule is a bit bigger than usual. The two scans are identical, I just outlined the one on the right to help you understand what you are looking at. The probe is placed on the skin which is at the very top of the picture and sound waves are directed deep into the neck and thyroid (toward the bottom of the picture). As sound waves hit structures they bounce back like an echo. The probe detects these reflections to make pictures. This nodule (**shown in red**) comprises about 80% of the thyroid tissue (**shown in yellow**) in this particular area of the thyroid. If you looked at other parts of the thyroid, however, you would not see the nodule and you would only see normal thyroid tissue.

There are certain characteristics of thyroid nodules seen on ultrasound which are more worrisome than others. Keep in mind, however, that ultrasound alone cannot make the diagnosis of cancer! This test will usually help tell us that the nodule has a low chance of being cancer (has characteristics of a benign nodule), or that it has some characteristics of a cancerous nodule and therefore a biopsy is indicated.

Ultrasound Characteristics Which Suggest a Benign Nodule

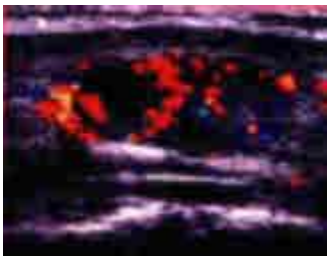
✔**Nice sharp edges are seen all around the nodule**

✔**Nodule filled with fluid and not live tissue (a cyst)**

✔**Lots of nodules throughout the thyroid (almost always a benign multi-nodular goiter)**

✔**No blood flowing through it (not live tissue, likely a cyst)**

✔More on this topic on our FNA Page.



To illustrate some of these points a little, the next picture shows the same ultrasound as above, but this time we programmed the probe to detect **blood flow**. You can now clearly see that this nodule is complex...which means that some of it is cystic, while other parts are comprised of live tissues which have a good blood supply. If this were a simple cyst filled with serous fluid, then it would have no **red** (artery) or **blue** (vein) blood flow.

This patient had no other nodules in her thyroid, so this was diagnosed as a "dominant complex nodule of the right thyroid lobe"

Since this nodule does have a few worrisome characteristics, we performed a fine needle aspirate biopsy (FNA). In this test, a very small needle is passed into the nodule and some cells are aspirated out and then placed on a glass slide for a pathologist to stain and determine if they are malignant or not. This test is very simple, takes less than 30 seconds, is virtually pain free, and can be very accurate. If it is read as cancer, this test is almost always right. Sometimes, however, there are not enough cells removed or some but not all cells look abnormal. In this case, the pathologist will not be able to tell cancer from a benign nodule. This situation usually dictates that the test be repeated or that the patient undergoes surgical removal of this part of the thyroid. Remember, the vast majority of nodules are benign, and even if it is cancer, most thyroid cancers are extremely curable!

✔This patient had 2 indeterminate FNA's performed. Both needle biopsies had good tissue specimens, but the pathologist could not distinguish benign from cancer. She subsequently underwent a simple right thyroid lobectomy and the final diagnosis was a benign follicular adenoma. She did fine after the operation and has enough normal thyroid still in her neck so that she does not have to take thyroid hormone pills.

Hyperthyroidism
Overactivity of the thyroid gland

Part 1: INTRODUCTION

This is a large topic so we have split it into four manageable sized portions.
This page introduces hyperthyroidism. Subsequent pages are listed at the bottom which address more specific details of making the diagnosis, the causes, and different treatment options.

In healthy people, the thyroid makes just the right amounts of two hormones, T4 and T3, which have important actions throughout the body. These hormones regulate many aspects of our metabolism, eventually affecting how many calories we burn, how warm we feel, and how much we weigh. **In short, the thyroid "runs" our metabolism.** These hormones also have direct effects on most organs, including the heart which beats faster and harder under the influence of thyroid hormones. Essentially all cells in the body will respond to increases in thyroid hormone with an increase in the rate at which they conduct their business. **Hyperthyroidism is the medical term to describe the signs and symptoms associated with an over production of thyroid hormone.** For an overview of how thyroid hormone is produced and how its production is regulated check out our thyroid hormone production page.

Hyperthyroidism is a condition caused by the effects of too much thyroid hormone on tissues of the body. Although there are several different causes of hyperthyroidism, most of the symptoms that patients experience are the same regardless of the cause (see the list of symptoms below). Because the body's metabolism is increased, patients often feel hotter than those around them and can slowly lose weight even though they may be eating more. The weight issue is confusing sometimes since some patients actually gain weight because of an increase in their appetite. Patients with hyperthyroidism usually experience fatigue at the end of the day, but have trouble sleeping. Trembling of the hands and a hard or irregular heartbeat (called palpitations) may develop. These individuals may become irritable and easily upset. When hyperthyroidism is severe, patients can suffer shortness of breath, chest pain, and muscle weakness. Usually the symptoms of hyperthyroidism are so gradual in their onset that patients don't realize the

symptoms until they become more severe. This means the symptoms may continue for weeks or months before patients fully realize that they are sick. In older people, some or all of the typical symptoms of hyperthyroidism may be absent, and the patient may just lose weight or become depressed.

Common symptoms and signs of hyperthyroidism

- **Palpitations**
- **Heat intolerance**
- **Nervousness**
- **Insomnia**
- **Breathlessness**
- **Increased bowel movements**
- **Light or absent menstrual periods**
- **Fatigue**

- **Fast heart rate**
- **Trembling hands**
- **Weight loss**
- **Muscle weakness**
- **Warm moist skin**
- **Hair loss**
- **Staring gaze**

Remember, the words "signs" and "symptoms" have different medical meanings. Symptoms are those problems that a patient notices or feels. Signs are those things that a physician can objectively detect or measure. For instance, a patient will feel hot, this is a symptom. The physician will touch the patient's skin and note that it is warm and moist, this is a sign.

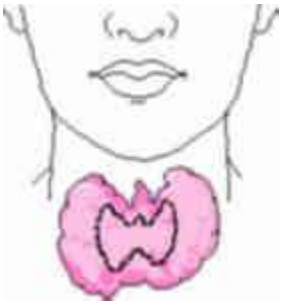
Part 2: CAUSES

There are several causes of hyperthyroidism. Most often, the entire gland is overproducing thyroid hormone. Less commonly, a single nodule is responsible for the excess hormone secretion.

The most common underlying cause of hyperthyroidism is Graves' disease, a condition named for an Irish doctor who first described the condition. This condition can be summarized by noting that an enlarged thyroid (enlarged thyroids are called goiters) is producing way too much thyroid hormone. [Remember that only a small percentage of goiters produce too much thyroid hormone, the majority actually become large because they are not producing enough thyroid hormone]. Graves' disease is classified as an autoimmune disease, a condition

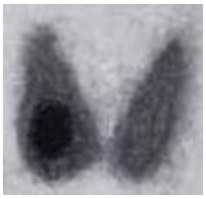
caused by the patient's own immune system turning against the patient's own thyroid gland. The hyperthyroidism of Graves' disease, therefore, is caused by antibodies that the patient's immune system makes which attach to specific activating sites on thyroid gland which in turn cause the thyroid to make more hormone. There are actually three distinct parts of Graves' disease: [1] overactivity of the thyroid gland (hyperthyroidism), [2] inflammation of the tissues around the eyes causing swelling, and [3] thickening of the skin over the lower legs (pretibial myxedema). Most patients with Graves' disease, however, have no obvious eye involvement. Their eyes may feel irritated or they may look like they are staring. About one out of 20 people with Graves' disease will suffer more severe eye problems, which can include bulging of the eyes, severe inflammation, double vision, or blurred vision. If these serious problems are not recognized and treated, they can permanently damage the eyes and even cause blindness. Thyroid and eye involvement in Graves' disease generally run a parallel course, with eye problems resolving slowly after hyperthyroidism is controlled.

Characteristics of Graves Disease



- Affects women much more often than men (about 8:1)
- Often called diffuse toxic goiter because the entire gland is enlarged
- Uncommon over the age of 50 (more common in the 30's and 40's)
- Tends to run in families (not known why)

Other Less Common Causes of Hyperthyroidism



Hyperthyroidism can also be caused by a single nodule within the thyroid instead of the entire thyroid. As outlined in detail on our nodules page, thyroid nodules usually represent benign (non-cancerous) lumps or tumors in the gland. These nodules sometimes produce excessive amounts of thyroid hormones. This condition is called "toxic nodular goiter". The picture on the right is an iodine scan (also simply called a thyroid scan) which shows a normal sized thyroid gland (shaped like a butterfly). This scan is abnormal because a solitary "**hot**" nodule is located in the right lower lobe. This single nodule is comprised of thyroid cells which have lost their regulatory

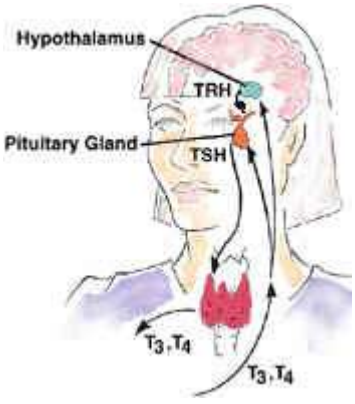
mechanism which dictates how much hormone to produce. Without this regulatory control, the cells in this nodule produce thyroid hormone at a dramatically increased rate causing the symptoms of hyperthyroidism. [As a point of reference, some nodules are "cold" since they don't produce any hormone at all. There is a picture of a cold nodule on the nodule page.]

Inflammation of the thyroid gland, called thyroiditis, can lead to the release of excess amounts of thyroid hormones that are normally stored in the gland. In subacute thyroiditis, the painful inflammation of the gland is believed to be caused by a virus, and the hyperthyroidism lasts a few weeks. A more common painless form of thyroiditis occurs in one out of 20 women, a few months after delivering a baby and is, therefore, known as postpartum thyroiditis. Although hyperthyroidism caused by thyroiditis causes the typical symptoms listed on our introduction to hyperthyroidism page, they generally last only a few weeks until the thyroid hormone stored in the gland has been exhausted. For more about thyroiditis see our page on this topic.

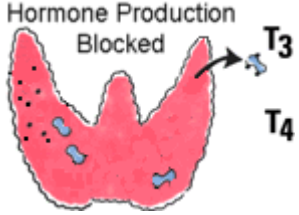
Hyperthyroidism can also occur in patients who take excessive doses of any of the available forms of thyroid hormone. This is a particular problem in patients who take forms of thyroid medication that contains T3, which is normally produced in relatively small amounts by the human thyroid gland. Other forms of hyperthyroidism are even rarer. It is important for your doctor to determine which form of hyperthyroidism you may have since the best treatment options will change depending on the underlying cause.

Hyperthyroidism
Overactivity of the thyroid gland

Part 3: MAKING THE DIAGNOSIS



The actual diagnosis of hyperthyroidism is easy to make once its possibility is entertained. **Accurate and widely available blood tests can confirm or rule out the diagnosis quite easily within a day or two.** Levels of the thyroid hormones themselves, T4 and T3 are measured in blood and one or both must be high for this diagnosis to be made. It is also useful to measure the level of thyroid-stimulating hormone (TSH). This hormone is secreted from the pituitary gland (shown in orange) with the purpose of stimulating the thyroid to produce thyroid hormone. The pituitary constantly monitors our thyroid hormone levels and, if it senses the slightest excess of thyroid hormone in blood, it stops producing TSH. Consequently, a low blood TSH strongly suggests that the thyroid is overproducing hormone on its own. Other special tests are occasionally use to distinguish among the various causes of



hyperthyroidism. Because the thyroid gland normally takes up iodine in order to make thyroid hormones, measuring how much radioactive iodine or technetium is captured by the gland can be a very useful way to measure its function. The dose of radiation with these tests is very small and has no side effects. Such radioactive thyroid scan and uptake tests are often essential to know what treatment should be used in a patient with hyperthyroidism. This is easily demonstrated on our causes of hyperthyroidism page which shows a hot nodule.

Common tests used to diagnose hyperthyroidism

- Thyroid stimulating hormone (TSH) produced by the pituitary [will be decreased in hyperthyroidism]
- Thyroid hormones themselves (T3, T4, T7) [will be increased]
- Iodine thyroid scan [will show if the cause is a single nodule or the whole gland]

✔✔We now have a new page that examines in detail all the Laboratory and X-ray Tests used to diagnose thyroid diseases, including a description of these tests and what they mean

Hyperthyroidism
Overactivity of the thyroid gland

Part 4: TREATMENT OPTIONS

There are readily available and effective treatments for all common types of hyperthyroidism. Some of the symptoms such as tremor and palpitations which are caused by excess thyroid hormone acting on the cardiac and nervous system can be improved within a number of hours by medications called beta-blockers (e.g., propranolol; Inderal). Beta-blockers do not cure the hyperthyroidism and do not decrease the amount of thyroid hormone being produced, they just prevent some of the symptoms. For patients with temporary forms of hyperthyroidism (thyroiditis or taking excess thyroid medications), beta blockers may be the only treatment required.

Anti-Thyroid Drugs

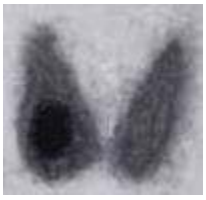
For patients with sustained forms of hyperthyroidism, such as Graves' disease or toxic nodular goiter, antithyroid medications are often used. The goal with this form of drug therapy is to prevent the thyroid from producing hormones. Two common drugs in this category are methimazole and propylthiouracil (PTU) both of which actually

interfere with the thyroid gland's ability to make its hormones. The illustration shows that some hormone is made, but the thyroid becomes much less efficient. When taken faithfully, these drugs are usually very effective in controlling hyperthyroidism within a few weeks. Antithyroid drugs can have side effects such as rash, itching, or fever, but these are uncommon. Very rarely, patients treated with these medications can develop liver inflammation or a deficiency of white blood cells therefore, patients taking antithyroid drugs should be aware that they must stop their medication and call their doctor promptly if they develop yellowing of the skin, a high fever, or severe sore throat. The main shortcoming of antithyroid drugs is that the underlying hyperthyroidism often comes back after they are discontinued. For this reason, many patients with hyperthyroidism are advised to consider a treatment that permanently prevents the thyroid gland from producing too much thyroid hormone.

Radioactive Iodine Treatment

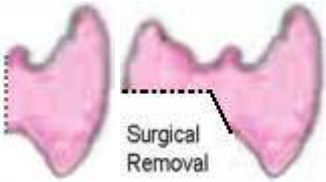
Radioactive iodine is the most widely recommended permanent treatment of hyperthyroidism. This treatment takes advantage of the fact that thyroid cells are the only cells in the body which have the ability to absorb iodine. In fact, thyroid hormones are experts at doing just that. By giving a radioactive form of iodine gives off a poisonous type of radiation, the thyroid cells which absorb it will be damaged or killed. Because iodine is not concentrated by any other cells in the body, there is very little radiation exposure (or side effects!) for the rest of the body. Radioiodine can be taken by mouth without the need to be hospitalized. This form of therapy often takes one to two months before the thyroid has been killed, but the radioactivity medicine is completely gone from the body within a few days. The majority of patients are cured with a single dose of radioactive iodine. The only common side effect of radioactive iodine treatment is underactivity of the thyroid gland. The problem here, is that the amount of radioactive iodine given kills too many of the thyroid cells so that the remaining thyroid does not produce enough hormone, a condition called hypothyroidism. **There is no evidence that radioactive iodine treatment of hyperthyroidism causes cancer of the thyroid gland or other parts of the body**, or that it interferes with a woman's chances of becoming pregnant and delivering a healthy baby in the future. It is also important to realize that **there are different types of radioactive iodine (isotopes)**. The type used for thyroid scans (iodine scans) as shown in the picture below give up a much milder type of radioactivity which does NOT kill thyroid cells.

Surgical Removal of the Gland or Nodule



Another permanent cure for hyperthyroidism is to surgically remove all or part. Surgery is not used as frequently as the other treatments for this disease. The biggest reason for this is that the most common forms of hyperthyroidism are a result of overproduction from the entire gland (Graves' Disease) and the methods described above work quite well in the vast majority of cases. Although there are some Graves' Disease patients who will need to have surgical removal of their thyroid (cannot

tolerate medicines for one reason or another, or who refuse radioactive iodine), other causes of hyperthyroidism can be better suited for surgical treatment earlier in the disease. One such case is illustrated here where a patient has hyperthyroidism due to a hot nodule in the lower aspect of the right thyroid lobe. Depending on the location of the nodule, the surgeon can remove the lower portion of the lobe as illustrated on the left, or he/she may need to remove the entire lobe which contains the hot nodule as shown in the second picture. This should provide a long term cure.



▶ Concerns about long hospitalizations following thyroid surgery have been all but alleviated over the past few years since many surgeons are now sending their patients home the morning following surgery (23 hour stay). This of course depends on the underlying health of the patient and their age, among other factors. Some are even treating partial thyroidectomy as an out patient procedure where healthy patients can be sent home a few hours post op. Although most surgeons require that the patient be put to sleep for operations on the thyroid gland, a some are even removing one side of the gland under local anesthesia with the aid of IV sedation. These smaller operations tend to be associated with fewer complaints.

▶ A potential down side of the surgical approach is that there is a small risk of injury to structures near the thyroid gland in the neck including the nerve to the voice box (the recurrent laryngeal nerve). The incidence of this is about 1%. Like radioactive iodine treatment, surgery often results in hypothyroidism. This fact is obvious when the entire gland is removed, but it may occur following a lobectomy as well. Whenever hypothyroidism occurs after treatment of an overactive thyroid gland, it can be easily diagnosed and effectively treated with levothyroxine. Levothyroxine fully replaces thyroid hormones deficiency and, when used in the correct dose , can be safely taken for the remainder of a patient's life without side effects or complications. Just one small pill per day.

Hypothyroidism
Too little thyroid hormone

Part 1: Introduction, Causes, and Symptoms

Updated November 27, 2003

▶ **Hypothyroidism is a condition in which the body lacks sufficient thyroid hormone.** Since the main purpose of thyroid hormone is to "run the body's metabolism", it is understandable that people with this condition will have symptoms associated with a slow metabolism. Over five million Americans have this common medical condition. In fact, as many as ten percent of women may have some degree of thyroid hormone deficiency. Hypothyroidism is more common than you would believe...and, millions of

people are currently hypothyroid and don't know it! [For an overview of how thyroid hormone is produced and how its production is regulated check out our thyroid hormone production page.]

There are two fairly common causes of hypothyroidism. The first is a result of previous (or currently ongoing) **inflammation of the thyroid gland** which leaves a large percentage of the cells of the thyroid damaged (or dead) and incapable of producing sufficient hormone. The most common cause of thyroid gland failure is called **autoimmune thyroiditis** (also called Hashimoto's thyroiditis), a form of thyroid inflammation caused by the patient's own immune system. **The second major cause is the broad category of "medical treatments".** As noted on a number of our other pages, the treatment of many thyroid conditions warrants **surgical removal** of a portion or all of the thyroid gland. If the total mass of thyroid producing cells left within the body are not enough to meet the needs of the body, the patient will develop hypothyroidism. Remember, this is often the goal of the surgery as seen in surgery for thyroid cancer. But at other times, the surgery will be to remove a worrisome nodule, leaving half of the thyroid in the neck undisturbed. Sometimes (often), this remaining thyroid lobe and isthmus will produce enough hormone to meet the demands of the body. For other patients, however, it may become apparent years later that the remaining thyroid just can't quite keep up with demand. Similarly, goiters and some other thyroid conditions can be treated with **radioactive iodine therapy**. The aim of the radioactive iodine therapy (for benign conditions) is to kill a portion of the thyroid to [1] prevent goiters from growing larger, or [2] producing too **much** hormone (hyperthyroidism). Occasionally, (often?) the result of radioactive iodine treatment will be that too many cells are damaged so the patient often becomes hypothyroid a year or two later. This is O.K. and usually greatly preferred over the original problem. There are several other **rare causes of hypothyroidism**, one of them being a completely "normal" thyroid gland which is not making enough hormone because of a problem in the pituitary gland. If the pituitary does not produce enough Thyroid Stimulating Hormone (TSH) then the thyroid simply does not have the "signal" to make hormone, so it doesn't.

Symptoms of Hypothyroidism

- **Fatigue**
- **Weakness**
- **Weight gain or increased difficulty losing weight**
- **Coarse, dry hair**
- **Dry, rough pale skin**
- **Hair loss**
- **Cold intolerance** (can't tolerate the cold like those around you)
- **Muscle cramps and frequent muscle aches**
- **Constipation**
- **Depression**
- **Irritability**

- **Memory loss**
- **Abnormal menstrual cycles**
- **Decreased libido**

Each individual patient will have any number of these symptoms which will vary with the severity of the thyroid hormone deficiency and the length of time the body has been deprived of the proper amount of hormone. Some patients will have one of these symptoms as their main complaint, while another will not have that problem at all and will be suffering from a different symptom. Most will have a combination of a number of these symptoms. Occasionally, some patients with hypothyroidism have no symptoms at all, or they are just so subtle that they go unnoticed. **Note:** Although this may sound obvious, if you have these symptoms, you need to discuss them with your doctor and probably seek the skills of an endocrinologist. If you have already been diagnosed and treated for hypothyroidism and you continue to have any or all of these symptoms, you need to discuss it with your physician. Although treatment of hypothyroidism can be quite easy in some individuals, others will have a difficult time finding the right type and amount of replacement thyroid hormone. (More about this on the next page).

Potential Dangers of Hypothyroidism

Because the body is expecting a certain amount of thyroid hormone the pituitary will make additional thyroid-stimulating-hormone (TSH) in an attempt to entice the thyroid to produce more hormone. This constant bombardment with high levels of TSH may cause the thyroid gland to become enlarged and form a goiter (termed a "compensatory goiter"). Our goiter page goes into this topic in detail, and outlines that a deficiency of thyroid hormone is a common cause of goiter formation. Left untreated, the symptoms of hypothyroidism will usually progress. Rarely, complications can result in severe life-threatening depression, heart failure or coma.

- **Hypothyroidism can often be diagnosed with a simple blood test.** In some persons, however, its not so simple and more detailed tests are needed. Most importantly, a good relationship with a good endocrinologist will almost surely be needed. More about treatment on another page.
- **Hypothyroidism is completely treatable in many patients simply by taking a small pill once a day!** Once again, however, we have made a simplified statement and its not always so easy. There are several types of thyroid hormone preparations and one type of medicine will not be the best therapy for all patients. Many factors will go into the treatment of hypothyroidism and it is different for everybody. More about treatment on another page.

Hypothyroidism
Too little thyroid hormone

Part 2: Diagnosis and Treatments

Since hypothyroidism is caused by too little thyroid hormone secreted by the thyroid, **the diagnosis is based almost exclusively upon measuring the amount of thyroid hormone in the blood.** There are normal ranges which have been calculated by computers which measured these hormones in tens of thousands of people. If your hormone levels fall below the normal range, that is consistent with hypothyroidism. These tests are very accurate and reliable and are so routine that they are available to everybody. More about these tests on another page. NEW! However, its not always so simple...keep reading.

The idea is to measure blood levels of T4 and TSH. In the typical person with an under-active thyroid gland, the blood level of T4 (the main thyroid hormone) will be low, while the TSH level will be high. This means that the thyroid is not making enough hormone and the pituitary recognizes it and is responding appropriately by making more Thyroid Stimulating Hormone (TSH) in an attempt to force more hormone production out of the thyroid. In the more rare case of hypothyroidism due to pituitary failure, the thyroid hormone T4 will be low, but the TSH level will also be low. The thyroid is behaving "appropriately" under these conditions because it can only make hormone in response to TSH signals from the pituitary. Since the pituitary is not making enough TSH, then the thyroid will never make enough T4. The real question in this situation is what is wrong with the pituitary? But in the typical and most common form of hypothyroidism, the main thyroid hormone T4 is low, and the TSH level is high.

The next question is: When is low too low, and when is high too high? Blood levels have "normal" ranges, but other factors need to be taken into account as well, such as the presence or absence of symptoms. You should discuss your levels with your doctor so you can interpret how they are helping (or not?) fix your problems.

Oh, if only it were this simple all the time! Although the majority of individuals with hypothyroidism will be easy to diagnose with these simple blood tests, many millions will have this disease in mild to moderate forms which are more difficult to diagnose. The solution for these people is more complex and this is due to several factors. First we must realize that not all patients with hypothyroidism are the same. There are many degrees of this disease from very severe to very mild. Additionally, and very importantly, we cannot always predict just how bad (or good) an individual patient will feel just by examining his/her thyroid hormone levels. In other words, some patients

with very "mild" deviations in their thyroid laboratory test results will feel just fine while others will be quite symptomatic. The degree of thyroid hormone abnormalities often, but NOT ALWAYS will correlate with the degree of symptoms. It is important for both you and your physician to keep this in mind since the goal is not necessarily to make the lab tests go into the normal range, but to make you feel better as well! We must also keep in mind that even the "normal" thyroid hormone levels in the blood have a fairly large range, so even if a patient is in the "normal" range, it may not be the normal level for them.

For the majority of patients with hypothyroidism, taking some form of thyroid hormone replacement (synthetic or natural, pill or liquid, etc) will make the "thyroid function tests" return to the normal range, AND, this is accompanied by a general improvement in symptoms making the patient feel better. This does not happen to all individuals, however, and for these patients it is very important to find an endocrinologist who will listen and be sympathetic. (We aim to help you find this type of doctor.) Because most patients will be improved (or made completely better) when sufficient thyroid hormone is provided on a daily basis to make the hormone levels in the blood come into the normal range, physicians will often will rely on test results to determine when a patient is on the appropriate dose and therefore doing well. Remember, these tests have a wide normal range. Find a doctor who helps make you FEEL better, not just make your labs better because once given this diagnosis, you are likely to carry it for a long, long time. There is more than one drug, there is more than one lab test, and there is a "just right" doctor for everybody.

Treatment of Hypothyroidism

Hypothyroidism is usually quite easy to treat (for most people)! The easiest and most effective treatment is simply taking a thyroid hormone pill (Levothyroxine) once a day, preferably in the morning. This medication is a pure synthetic form of T4 which is made in a laboratory to be an exact replacement for the T4 that the human thyroid gland normally secretes. It comes in multiple strengths, which means that an appropriate dosage can almost always be found for each patient. The dosage should be re-evaluated and possibly adjusted monthly until the proper level is established. The dose should then be re-evaluated at least annually. If you are on this medication, make sure your physician knows it so he/she can check the levels at least yearly. **Note**: Just like we discussed above, however, this simple approach does not hold true for everybody. Occasionally the correct dosage is a bit difficult to pin-point and therefore you may need an exam and blood tests more frequently. Also, some patients just don't do well on some thyroid medications and will be quite happy on another. For these reasons you should **not** be shy in discussing with your doctor your blood hormone tests, symptoms, how you feel, and the type of medicine you are taking. The goal is to make you feel better, make your body last longer, slow the risk of heart disease and osteoporosis...in addition to making your blood levels normal! Sometimes that's easy, when its not, you need a physician who is willing to spend the time with you that you deserve while you explore different dosages other types of medications (or alternative diagnoses).

Some patients will notice a slight reduction in symptoms within 1 to 2 weeks, but **the full metabolic response to thyroid hormone therapy is often delayed for a month or two** before the patient feels completely normal. It is important that the correct amount of thyroid hormone is used. Not enough and the patient may have continued fatigue or some of the other symptoms of hypothyroidism. Too high a dose could cause symptoms of nervousness, palpitations or insomnia typical of hyperthyroidism. Some recent studies have suggested that too much thyroid hormone may cause increased calcium loss from bone increasing the patient's risk for osteoporosis. For patients with heart conditions or diseases, an optimal thyroid dose is particularly important. Even a slight excess may increase the patient's risk for heart attack or worsen angina. Some physicians feel that more frequent dose checks and blood hormone levels are appropriate in these patients.

After about one month of treatment, hormone levels are measured in the blood to establish whether the dose of thyroid hormone which the patient is taking is appropriate. We don't want too much given or subtle symptoms of hyperthyroidism could ensue, and too little would not alleviate the symptoms completely. Often blood samples are also checked to see if there are antibodies against the thyroid, a sign of autoimmune thyroiditis. Remember, this is the most common cause of hypothyroidism. Once treatment for hypothyroidism has been started, it typically will continue for the patient's life. Therefore, it is of great importance that the diagnosis be firmly established and you have a good relationship with a physician you like and trust.

Synthetic T4 can be safely taken with most other medications. Patients taking cholestyramine (a compound used to lower blood cholesterol) or certain medications for seizures should check with their physician about potential interactions. Women taking T4 who become pregnant should feel confident that the medication is exactly what their own thyroid gland would otherwise make. However, they should check with their physician since the T4 dose may have to be adjusted during pregnancy (usually more hormone is needed to meet the increased demands of the mother's new increased metabolism). There are other potential problems with other drugs including iron-containing vitamins. Once again, pregnant women (and all women and men for that matter) taking iron supplements should discuss this with your physician. There are three brand name Levothyroxine tablets now available. You may want to consult with your physician or pharmacist on the most cost effective brand since recent studies suggest that none is better than the other.

Thyroid Problems & Pregnancy

Headaches, anxiety, nervousness, and hypertension.

The most common thyroid disorder occurring around or during pregnancy is thyroid hormone deficiency, or hypothyroidism. The details of hypothyroidism are covered on several other pages on our site, so only those factors pertaining to pregnancy are discussed here. Hypothyroidism can cause a variety of changes in a woman's menstrual periods: irregularity, heavy periods, or loss of periods. When hypothyroidism is severe, it can reduce a woman's chances of becoming pregnant. Checking thyroid gland function with a simple blood test is an important part of evaluating a woman who has trouble becoming pregnant. If detected, an underactive thyroid gland can be easily treated with thyroid hormone replacement therapy. If thyroid blood tests are normal, however, treating an infertile woman with thyroid hormones will not help at all, and may cause other problems.

Because some of the symptoms of hypothyroidism such as tiredness and weight gain are already quite common in pregnant women, it is often overlooked and not considered as a possible cause of these symptoms. Blood tests, particularly measuring the TSH level, can determine whether a pregnant woman's problems are due to hypothyroidism or not.

Since thyroid medications (particularly Levothyroxine) are essentially identical to the thyroid hormone made by the normal thyroid gland, a woman with an underactive thyroid gland can feel confident that **it is perfectly safe to take thyroid hormone medication during pregnancy.** There are no side effects for the mother or the baby as long as the proper dose is used. In the case where hypothyroidism in the mother is NOT detected, the thyroid will still develop normally in the baby.

Women with previously treated hypothyroidism should be aware that their dose of medication may have to be increased during pregnancy. They should contact their doctor, who should check their blood level of TSH periodically throughout pregnancy to see if their medication dose needs adjustment. Thyroid function tests should continue to be reviewed every 2-3 months throughout the pregnancy. After delivery, the thyroxine dose should be returned to the pre-pregnancy dose and thyroid function tests reviewed two months later.

Hyperthyroidism and Pregnancy

Hyperthyroidism refers to the signs and symptoms which are due to the production of too much thyroid hormone. [Hyperthyroidism is covered in great deal on other pages on this site (about 8 in all), so only that part of hyperthyroidism which pertains to the pregnant mother will be discussed here]. An overactive thyroid gland (hyperthyroidism) often has its onset in younger women. Because a woman may think that feeling warm, having a hard or fast heartbeats, nervousness, trouble sleeping, or nausea with weight loss are just parts of being pregnant, the symptoms and signs of this condition may be overlooked during

pregnancy.

In women who are not pregnant, hyperthyroidism can affect menstrual periods, making them irregular, lighter, or disappear altogether. It may be harder for hyperthyroid women to become pregnant, and they are more likely to have miscarriages. If a woman with infertility or repeated miscarriages has symptoms of hyperthyroidism, it is important to rule out this condition with thyroid blood tests. **It is very important that hyperthyroidism be controlled in pregnant women** since the risks of miscarriage or birth defects are much higher without therapy. Fortunately, there are effective treatments available. Antithyroid medications cut down the thyroid gland's overproduction of hormones and are reviewed on another page on this site. When taken faithfully, they control hyperthyroidism within a few weeks. In pregnant women thyroid experts consider propylthiouracil (PTU) the safest drug. Because PTU can also affect the baby's thyroid gland, it is very important that pregnant women be monitored closely with examinations and blood tests so that the PTU dose can be adjusted. In rare cases when a pregnant woman cannot take PTU for some reason (allergy or other side effects), surgery to remove the thyroid gland is the only alternative and should be undertaken prior to or even during the pregnancy if necessary. Although radioactive iodine is a very effective treatment for other patients with hyperthyroidism, it should never be given during pregnancy because the baby's thyroid gland could be damaged.

Because treating hyperthyroidism during pregnancy can be a bit tricky, it is usually best for women who plan to have children in the near future to have their thyroid condition permanently cured. Antithyroid medications alone may not be the best approach in these cases because hyperthyroidism often returns when medications is stopped. Radioactive iodine is the most widely recommended permanent treatment with surgical removal being the second (but widely used) choice. It is concentrated by thyroid cells and damages them with little radiation to the rest of the body. This is why it cannot be given to a pregnant woman, since the radioactive iodine could cross the placenta and destroy normal thyroid cells in the baby. The only common side effect of radioactive iodine treatment is underactivity of the thyroid gland, which occurs because too many thyroid cells were destroyed. This can be easily and safely treated with levothyroxine. There is no evidence that radioactive iodine treatment of hyperthyroidism interferes with a woman's future chances of becoming pregnant and delivering a healthy baby. For more information on the treatment options of hyperthyroidism see our page on this topic.

Thyroid Problems After Pregnancy

One of every twenty women develop thyroid inflammation within a few months after delivery of their baby, a condition called postpartum thyroiditis. This form of thyroid inflammation is painless and causes little or no gland enlargement. However, the condition interferes with the gland's production of thyroid hormones. Thyroid hormone may leak out of the inflamed gland in large amounts, causing hyperthyroidism that lasts

for several weeks. Later on, the injured gland may not be able to make enough thyroid hormone, resulting in temporary hypothyroidism. Symptoms of hyperthyroidism and hypothyroidism may not be recognized when they occur in a new mother. They may be simply attributed to lack of sleep, nervousness, or depression.

Thyroid Symptoms Occasionally Overlooked in New Mothers

Hyperthyroidism
- Fatigue
- Insomnia
- Nervousness
- Irritability

Hypothyroidism
- Fatigue
- Depression
- Easily upset
- Trouble losing weight

Postpartum thyroiditis goes away on its own after one to four months. While it is active, however, women often benefit from treatment for their thyroid hormone excess or deficiency. Some of the symptoms caused by too much thyroid hormone, such as tremor or palpitations, can be improved promptly by medications called beta-blockers(e.g., propranolol). Antithyroid drugs, radioactive iodine, and surgery do **not** need to be considered because this form of hyperthyroidism is only temporary. If thyroid hormone deficiency develops, it can be treated for one to six months with levothyroxine. Women who have had an episode of postpartum thyroiditis are very likely to develop the problem again after future pregnancies. Although each episode usually resolves completely, one out of four women with postpartum thyroiditis goes on to develop a permanently underactive thyroid gland in future. Of course, levothyroxine fully corrects their thyroid hormone deficiency, and when used in the correct dose, can be safely taken without side effects or complications.

Thyroid Problems in the Baby

Rarely, a baby may be born without a thyroid gland. This birth defect is **not** caused by thyroid problems in the mother. If an infant's hypothyroidism is not recognized and treated promptly, he/she will not develop normally. Therefore, all newborn babies in the United States routinely have a blood test to be sure that hypothyroidism is diagnosed and treated. Most thyroid medications will have no effect on the baby. The exception to this generality is the administration of radioactive iodine to the mother during pregnancy. Radioactive iodine can cross the placenta and it can destroy thyroid cells in the fetus.

Thyroiditis

Inflammation of the Thyroid Gland

Thyroiditis is an inflammation (not an infection) of the thyroid gland. Several types of thyroiditis exist and the treatment is different for each.

Hashimoto's Thyroiditis. **Hashimoto's Thyroiditis (also called autoimmune or chronic lymphocytic thyroiditis) is the most common type of thyroiditis.** It is named after the Japanese physician, Hakaru Hashimoto, that first described it in 1912. The thyroid gland is always enlarged, although only one side may be enlarged enough to feel. During the course of this disease, the cells of the thyroid becomes inefficient in converting iodine into thyroid hormone and "compensates" by enlarging (for a review of this process see our function page). The radioactive iodine uptake may be paradoxically high while the patient is hypothyroid because the gland retains the ability to take-up or "trap" iodine even after it has lost its ability to produce thyroid hormone. As the disease progresses, the TSH increases since the pituitary is trying to induce the thyroid to make more hormone, the T4 falls since the thyroid can't make it, and the patient becomes hypothyroid. The sequence of events can occur over a relatively short span of a few weeks or may take several years.

- Treatment is to start thyroid hormone replacement. This prevents or corrects the hypothyroidism and it also generally keeps the gland from getting larger.

- In most cases the thyroid gland will decrease in size once thyroid hormone replacement is started.

- Thyroid antibodies are present in 95% of patients with Hashimoto's Thyroiditis and serve as a useful "marker" in identifying the disease without thyroid biopsy or surgery.

- Thyroid antibodies may remain for years after the disease has been adequately treated and the patient is on thyroid hormone replacement.

De Quervain's Thyroiditis. De Quervain's Thyroiditis (also called subacute or granulomatous thyroiditis) was first described in 1904 and is **much less common than Hashimoto's Thyroiditis.** The thyroid gland generally swells rapidly and is **very painful and tender.** The gland discharges thyroid hormone into the blood and the patients become hyperthyroid; however the gland quits taking up iodine (radioactive iodine uptake is very low) and the hyperthyroidism generally resolves over the next several weeks.

- Patients frequently become ill with fever and prefer to be in bed.

- Thyroid antibodies are **not** present in the blood, but the sedimentation rate, which measures inflammation, is very high.

- Although this type of thyroiditis resembles an infection within the thyroid gland, no infectious agent has ever been identified and antibiotics are of no use.

- Treatment is usually bed rest and aspirin to reduce inflammation.

- Occasionally cortisone (steroids) (to reduce inflammation) and thyroid hormone (to "rest" the thyroid gland) may be used in prolonged cases.

- Nearly all patients recover and the thyroid gland returns to normal after several weeks or months.

- A few patients will become hypothyroid once the inflammation settles down and therefore will need to stay on thyroid hormone replacement indefinitely.

- Recurrences are uncommon.

Silent Thyroiditis. Silent Thyroiditis is the third and least common type of thyroiditis. It was not recognized until the 1970's although it probably existed and was treated as Graves' Disease before that. This type of thyroiditis resembles in part Hashimoto's Thyroiditis and in part De Quervain's Thyroiditis. The blood thyroid test are high and the radioactive iodine uptake is low (like De Quervain's Thyroiditis), but there is no pain and needle biopsy resembles Hashimoto's Thyroiditis. The majority of patients have been young women following pregnancy. The disease usually needs no treatment and 80% of patients show complete recovery and return of the thyroid gland to normal after three months. Symptoms are similar to Graves' Disease except milder. The thyroid gland is only slightly enlarged and exophthalmos (development of "bug eyes") does not occur. Treatment is usually bed rest with beta blockers to control palpitations (drugs to prevent rapid heart rates). Radioactive iodine, surgery, or antithyroid medication is never needed. A few patients have become permanently hypothyroid and needed to be placed on thyroid hormone.