# DISORDERS OF THE THYROID GLAND

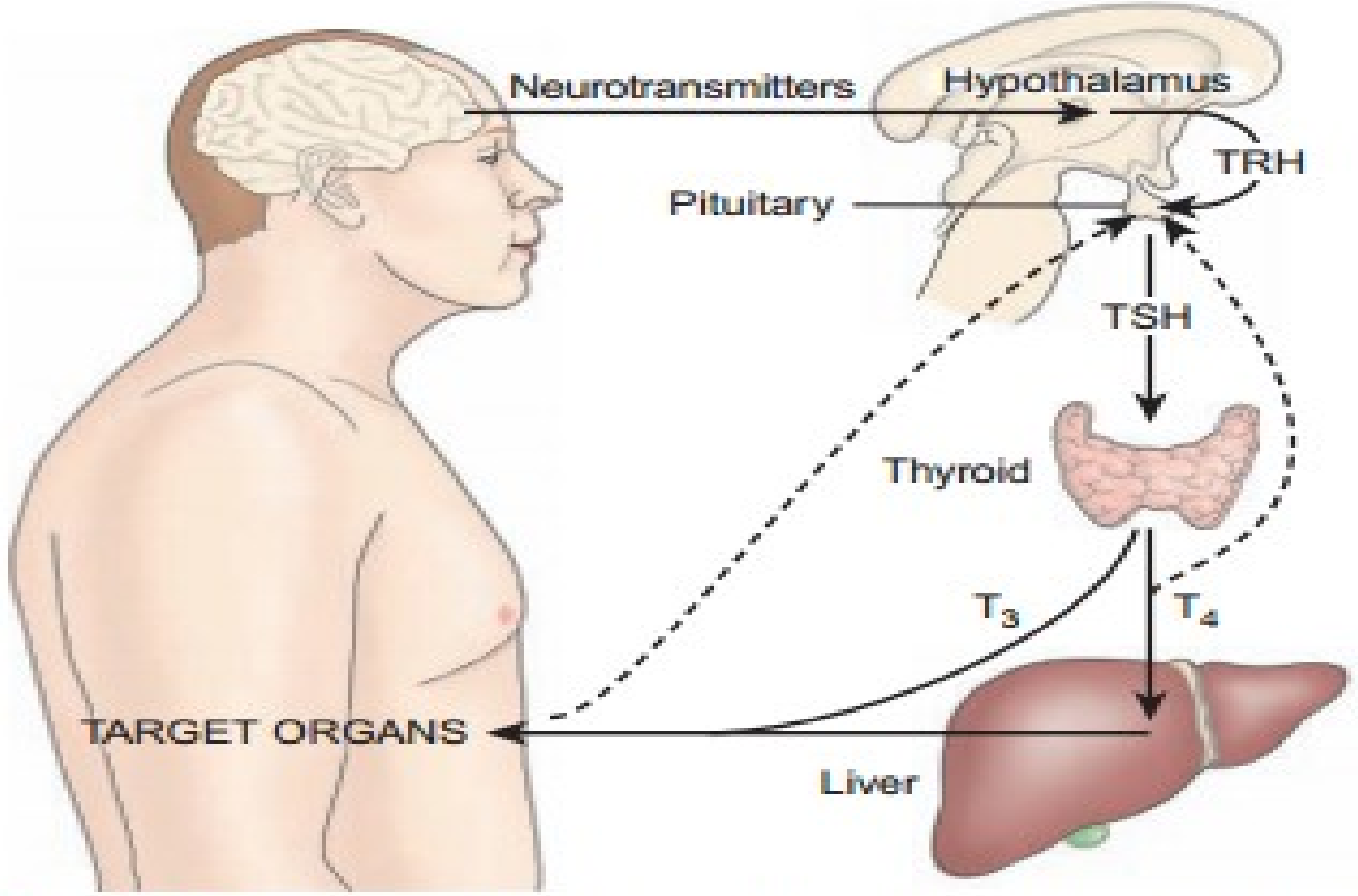
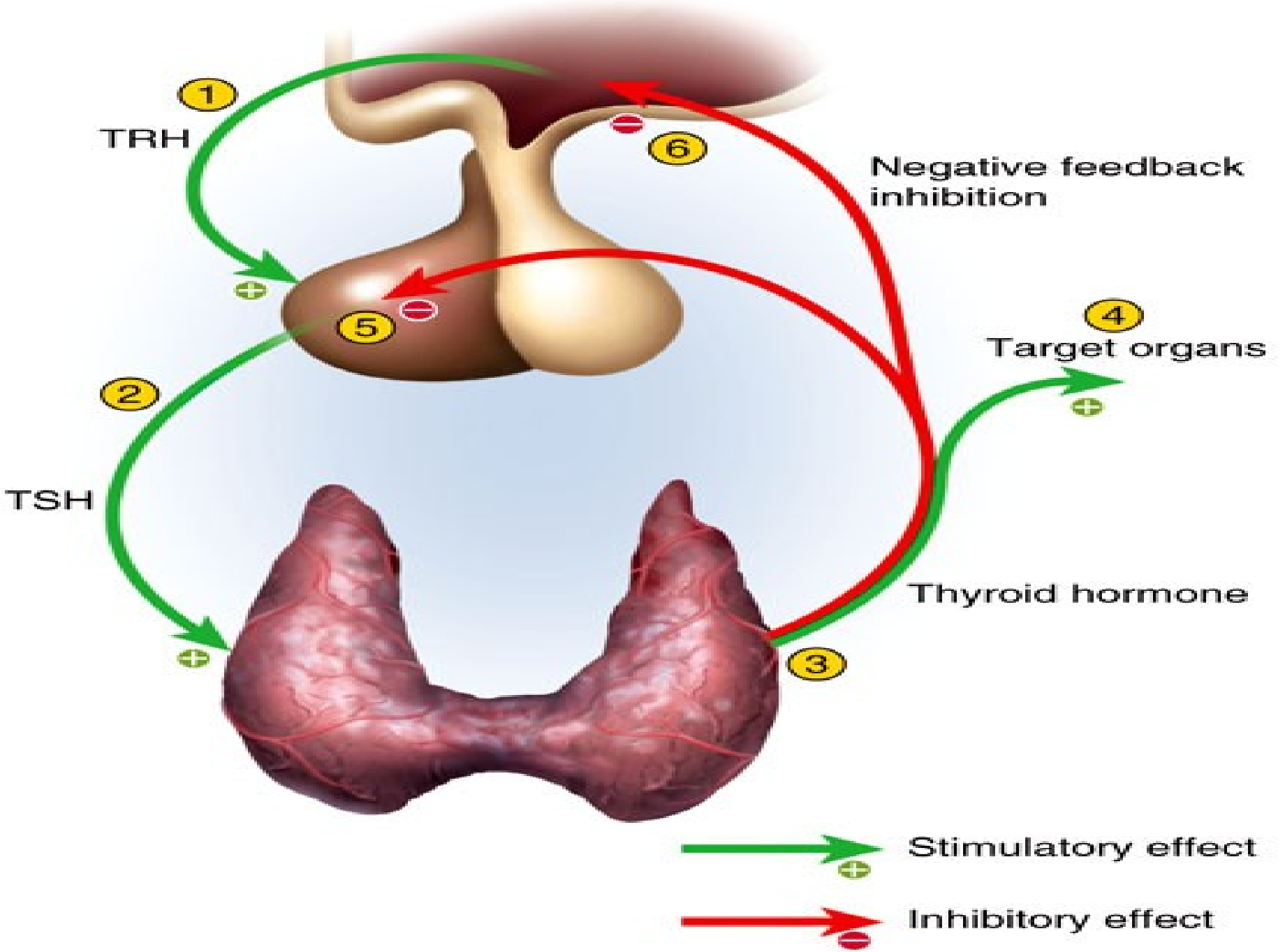


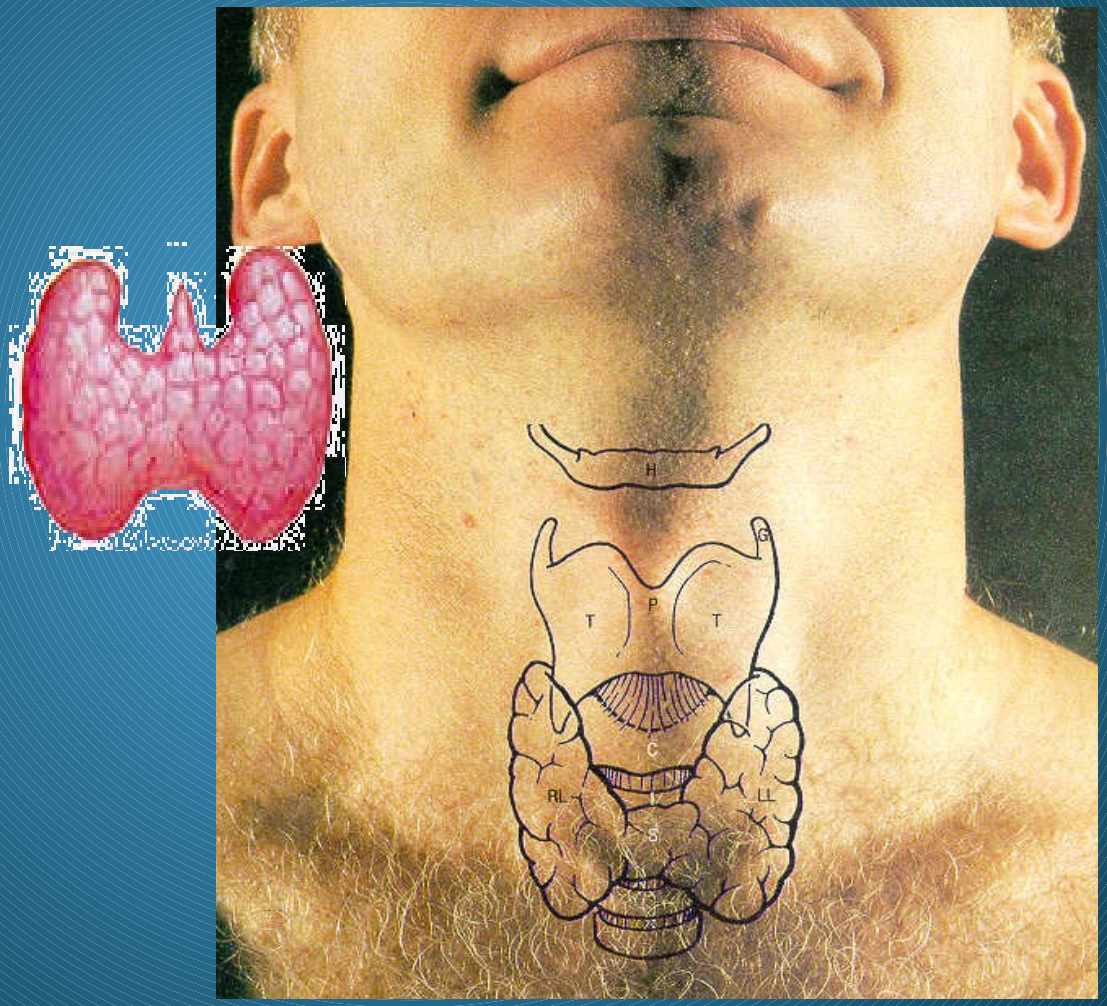

**Figure 42-4** The hypothalamic–pituitary–thyroid axis. Thyroid

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



## Butterfly-shaped organ in front of the neck

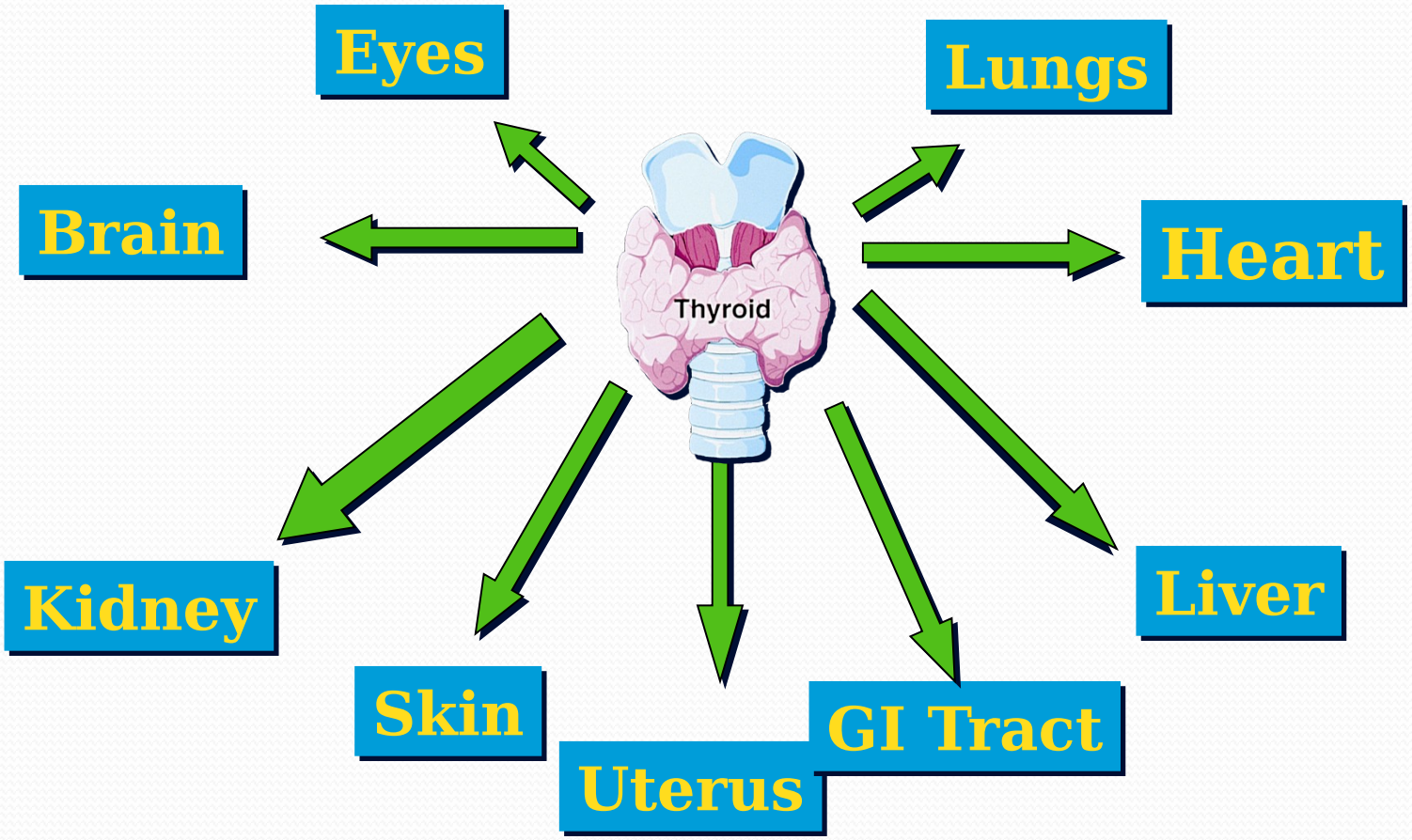
The gland is about 5 cm long and 3 cm wide and weighs about 30 g.

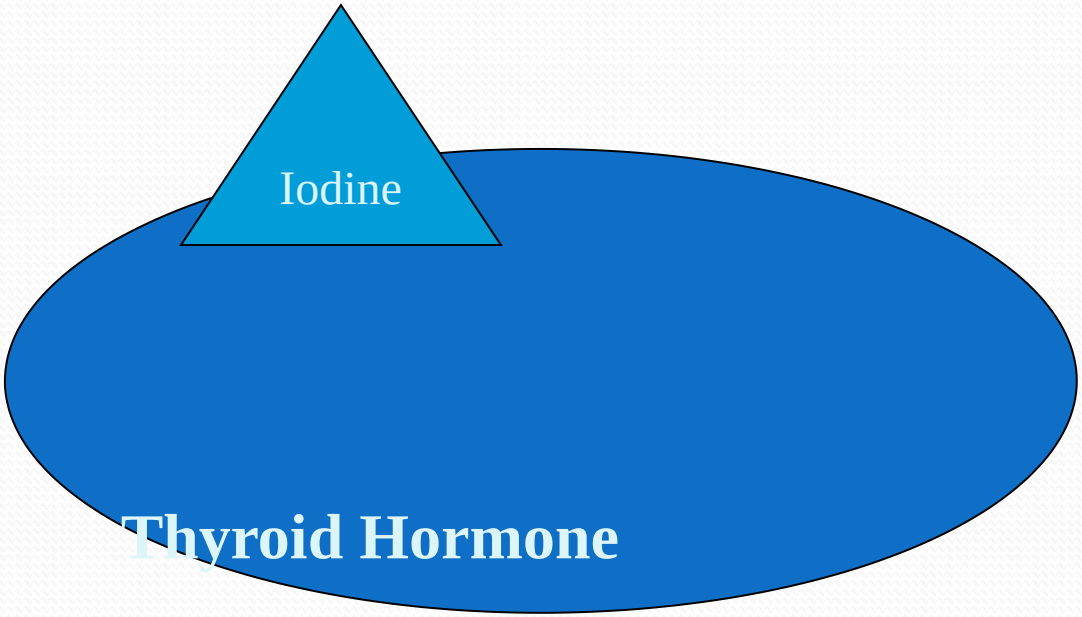


## What Does Your Thyroid Gland Do for You?

- Produces Two Hormones Called
  - Thyroxine (T4)
  - Thyronine (T3)
- Regulates Metabolism so Your Cells Function Properly
- Affects Every Cell in the Body

# Thyroid Hormone Affects Many Organs and General Health

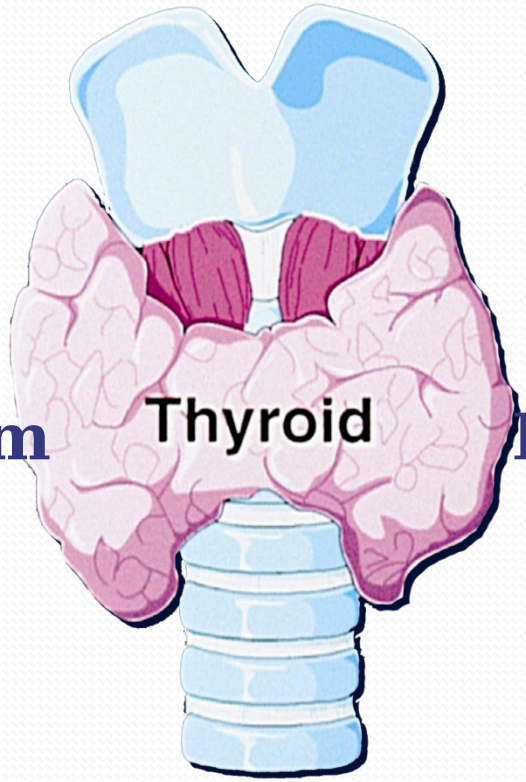





- Brain function, memory, concentration
- Muscle movement
- Cholesterol melting
- Normal heart beat

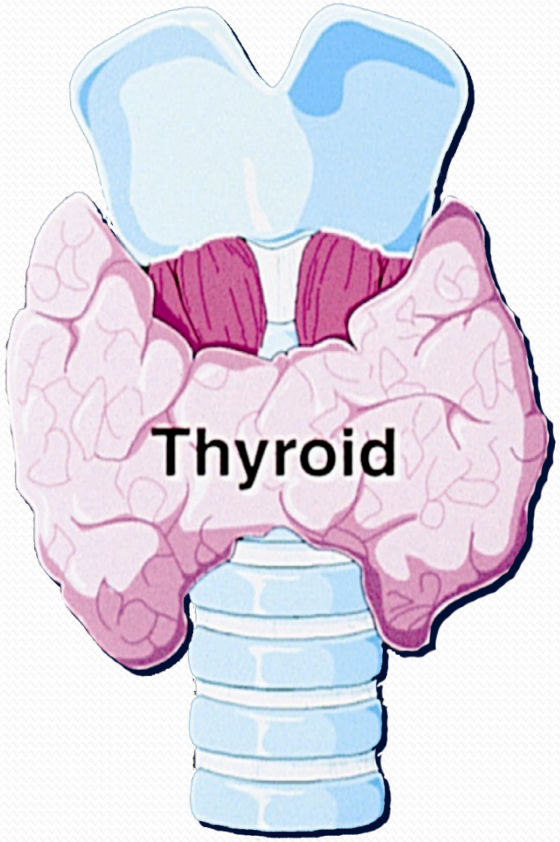
# When the Thyroid Doesn't Work

**Hyperthyroidism**




**Hypothyroidism**

# When the Thyroid Doesn't Work




**Hyperthyroidism**

- **Too Much Thyroid Hormone**
- **Metabolism Speeds Up**

**Hypothyroidism**

- **Too Little Thyroid Hormone**
- **Metabolism Slows Down**

# Two Common Types of Thyroid Disease



- Hyperthyroidism



- Hypothyroidism

# What causes Thyroid Diseases ?

The “Hidden” Health Problem

# What causes thyroid diseases ?

- Iodine deficiency disorder
- Surgical
- Radioiodine therapy
- Autoimmune diseases

# Clinical Expression of Iodine Deficiency

## Fetus

- Miscarriages
- Stillbirths
- Neurological cretinism
- Impaired intellectual function
- Increased perinatal mortality

## Neonate

- Increased infant mortality
- Neonatal goiter
- Cretinism
- Impaired intellectual function

# Clinical Expression of Iodine Deficiency

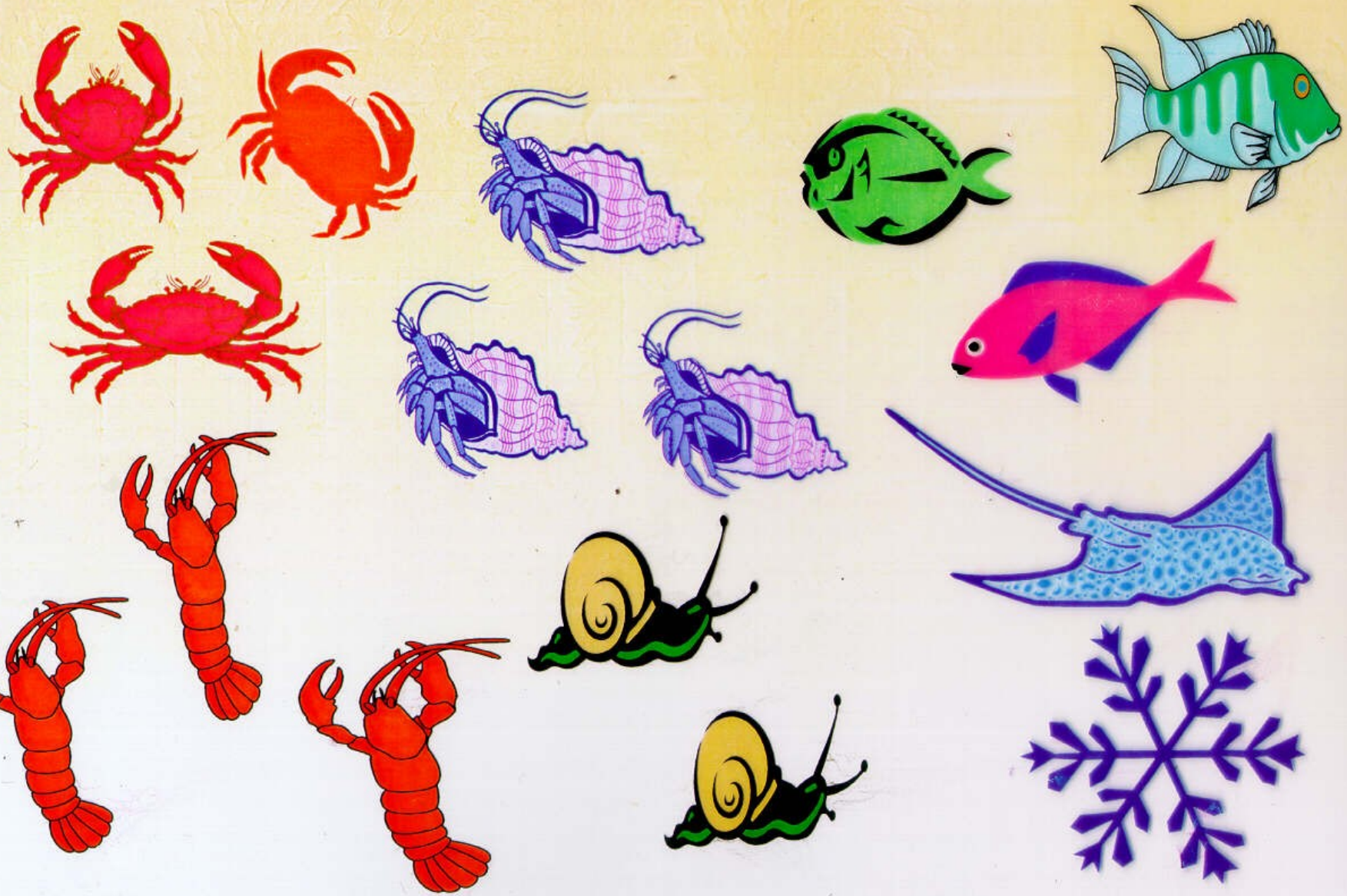
## Child & adolescent

- Goiter
- Hypothyroidism
- Impaired intellectual function
- Retarded physical development

## Adult

- Goiter
- Hypothyroidism and poor intellectual and physical performance

# SOURCES OF IODINE



# Sources of Dietary Iodine

- Iodine in soil, water and crops
- Seafood
- Dairy Products
- Iodised salt and other fortified foods
- Medicines/health foods/supplements
- Other adventitious sources

# THYROID GLAND…

- The blood flow to the thyroid is very high (about 5 mL/min per gram of thyroid tissue), approximately *five times* the blood flow to the liver.
- This reflects the high metabolic activity of the thyroid gland.
- The thyroid gland produces three hormones:
  - Thyroxine (T4),
  - Triiodothyronine (T3),and
  - Calcitonin

# THYROID GLAND…

**Thyroid Hormone**

- T4and T3, hormones produced by the thyroid gland.
- Both are amino acids that contain iodine molecules bound to the amino acid structure;
- T4contains four iodine atoms in each molecule, and
- T3 contains three.

# THYROID GLAND…

- Are synthesized and stored bound to proteins in the cells of the thyroid gland until needed for release into the bloodstream
- About 75% of bound thyroid hormone is bound to thyroxine binding globulin (TBG);
- The remaining bound to thyroid-binding prealbumin and albumin

# THYROID GLAND…

**Synthesis of Thyroid Hormone**

- Iodine is essential  for synthesis of its hormones.
- The major use of iodine in the body is by the thyroid, and
- The major derangement in iodine deficiency is alteration of thyroid function.

# THYROID GLAND…

- Iodide is ingested in the diet and absorbed into the blood in the GI tract
- The thyroid gland is extremely efficient at taking up iodide from the blood and concentrating it within the cells, where
  - Iodide ions are converted to iodine molecules, which react with tyrosine (an aa) to form the thyroid hormones

# THYROID GLAND…

**Regulation of Thyroid Hormone**

- The secretion of T3 and T4 by the gland is controlled by ***TSH*** (also called thyrotropin) from the **anterior pituitary gland.**
- TSH controls the rate of thyroid hormone release through a negative feedback mechanism.
- If the thyroid hormone concentration in the blood decreases, the release of TSH increases, which causes **increased output of T3 and T4**
- Euthyroid -thyroid hormone production that is within normal limits

# THYROID GLAND…

**Function of Thyroid Hormone**

- Control cellular metabolic activity
- T4, a relatively weak hormone, maintains body metabolism in a **steady state**
- T3 is about **five** times as potent as T4 and has a more rapid metabolic action
- These hormones accelerate metabolic processes by
  - Increasing the level of specific enzymes that contribute to oxygen consumption and
  - Altering the responsiveness of tissues to other hormones

# THYROID GLAND…

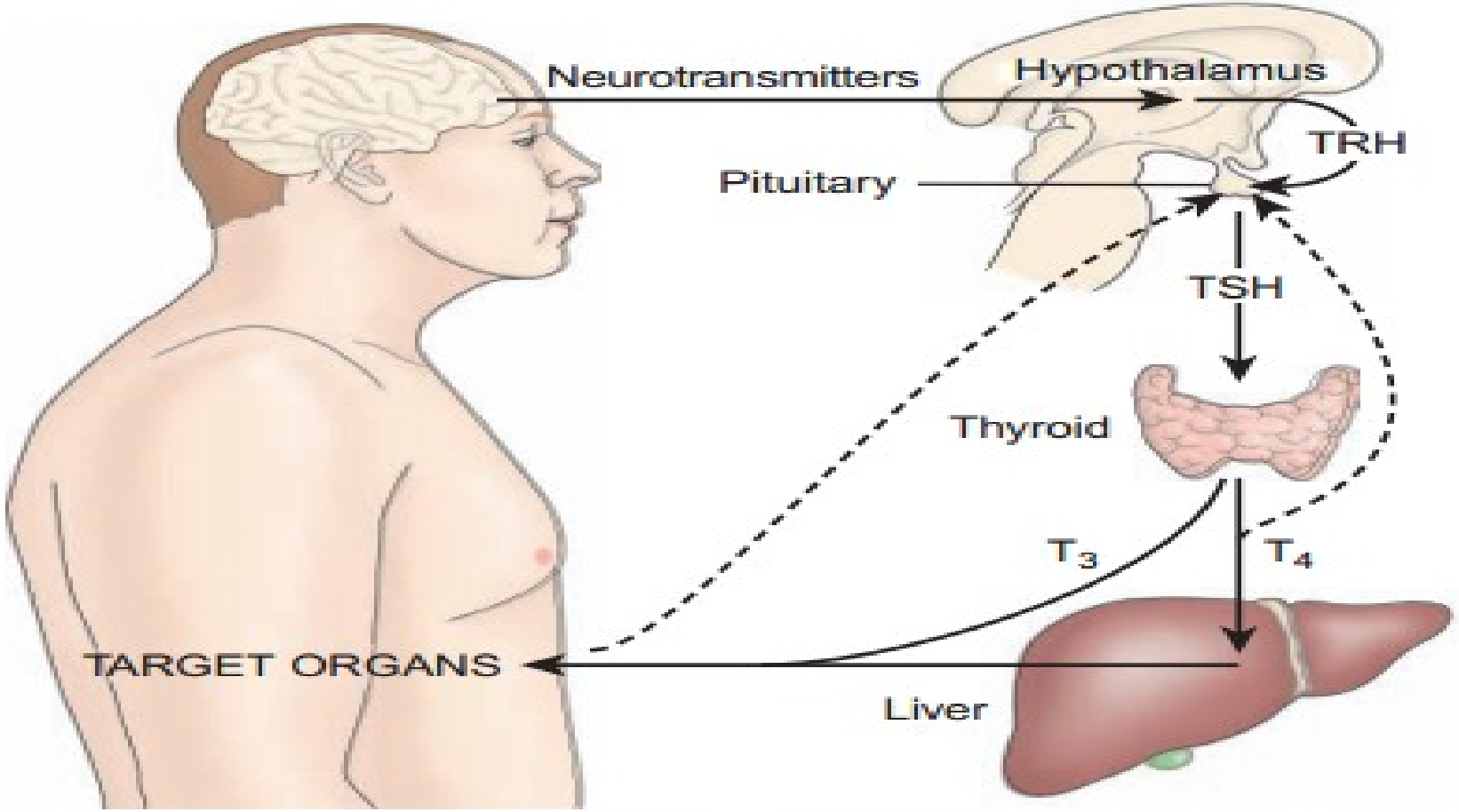



**Figure 42-4** The hypothalamic–pituitary–thyroid axis. Thyroid-releasing hormone (TRH) from the hypothalamus stimulates the pituitary gland to secrete thyroid-stimulating hormone (TSH). TSH stimulates the thyroid to produce thyroid hormone (triiodothyronine [$T_3$] and thyroxine [$T_4$]). High circulating levels of $T_3$ and $T_4$ inhibit further TSH secretion and thyroid hormone production through a negative feedback mechanism (*dashed lines*).

- **HYPERTHYROIDISM**

# HYPERTHYROIDISM

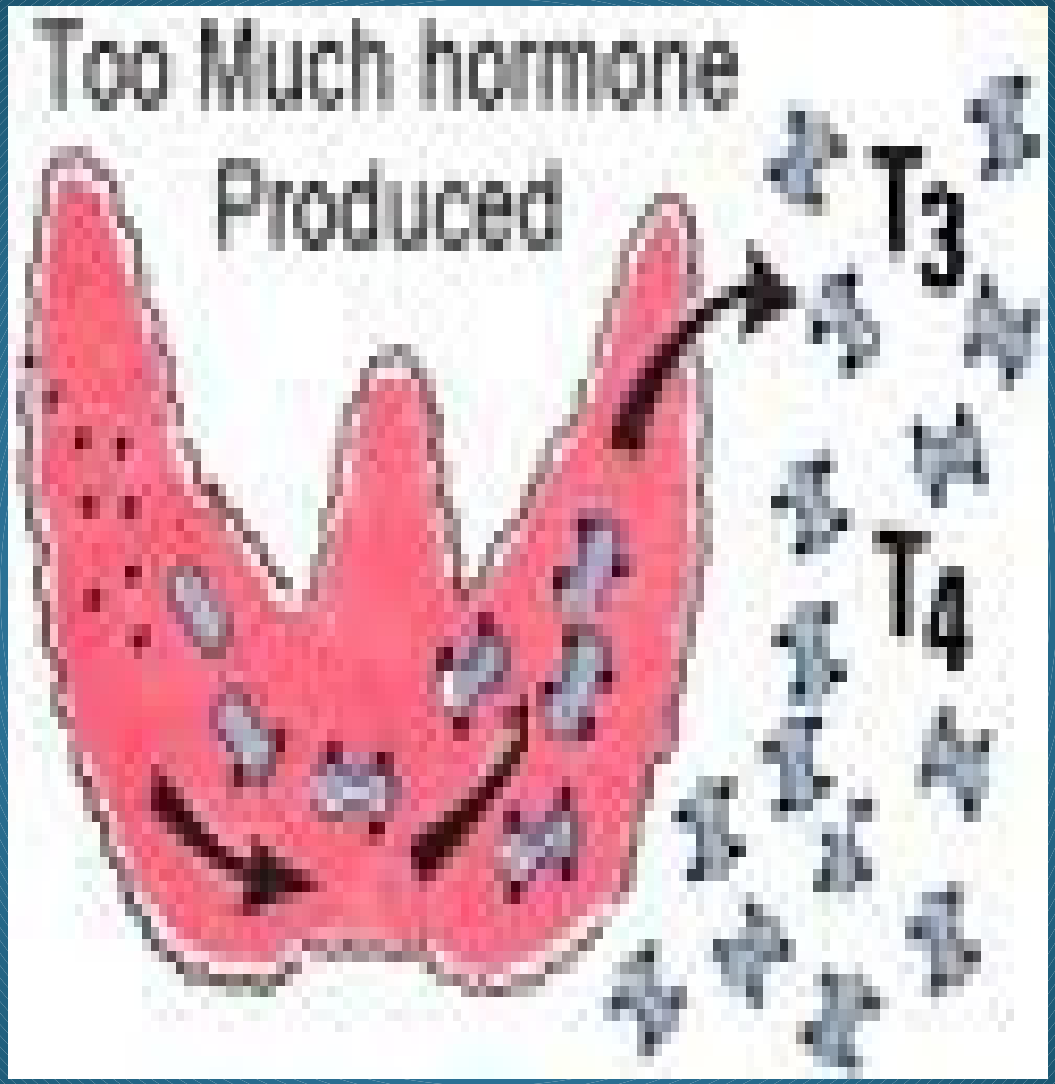
- Is the second most prevalent endocrine disorder, after DM.
- Graves' disease, the most common type of hyperthyroidism, results from an excessive output of thyroid hormones caused by abnormal stimulation of the thyroid gland by circulating immunoglobulin's

# Pathophysiology and Etiology

- No single etiologic factor for hyperthyroidism.
- Hyper secretion of thyroid hormones accompanies
  - Thyroid tumors
  - Pituitary tumors, and
  - Hypothalamic malignancies.
- It may result from stress, or infection.
- Excessive ingestion of thyroid hormone

- The metabolic rate increases because of the over secretion of the thyroid hormones thyroxine (T4) and triiodothyronine (T3)
- Both T4and T3 increase the metabolic rate.

# Hyperthyroidism



# Assessment Findings

**Signs and Symptoms**

- Symptoms vary from mild to severe.
- Clients with hyperthyroidism characteristically are restless despite feeling fatigued and weak, highly excitable, and constantly agitated.
- Fine tremors of the hands occur, causing unusual clumsiness
- The client cannot tolerate heat and has an increased appetite but loses weight.
- Diarrhea also occurs
- Visual changes, such as blurred or double vision, can develop.
- Exophthalmos, seen in clients with severe hyperthyroidism, results from enlarged muscle and fatty tissue surrounding the

## TABLE 50-1 Symptoms of Thyroid Dysfunction

| BODY SYSTEM OR FUNCTION | HYPERTHYROIDISM | HYPOTHYROIDISM |
|---|---|---|
| Metabolism | Increased, with symptoms of increased appetite, intolerance to heat, elevated body temperature, weight loss despite increased appetite | Decreased, with symptoms of anorexia, intolerance to cold, low body temperature, weight gain despite anorexia |
| Cardiovascular system | Tachycardia, moderate hypertension | Bradycardia, moderate hypotension |
| Central nervous system | Nervousness, anxiety, insomnia, tremors | Lethargy, sleepiness |
| Skin and skin structures | Flushed, warm, moist | Pale, cool, dry; face appears puffy, hair coarse; nails thick and hard |
| Ovarian function | Irregular or scant menses | Heavy menses, may be unable to conceive, loss of fetus also possible |
| Testicular function | | Low sperm count |

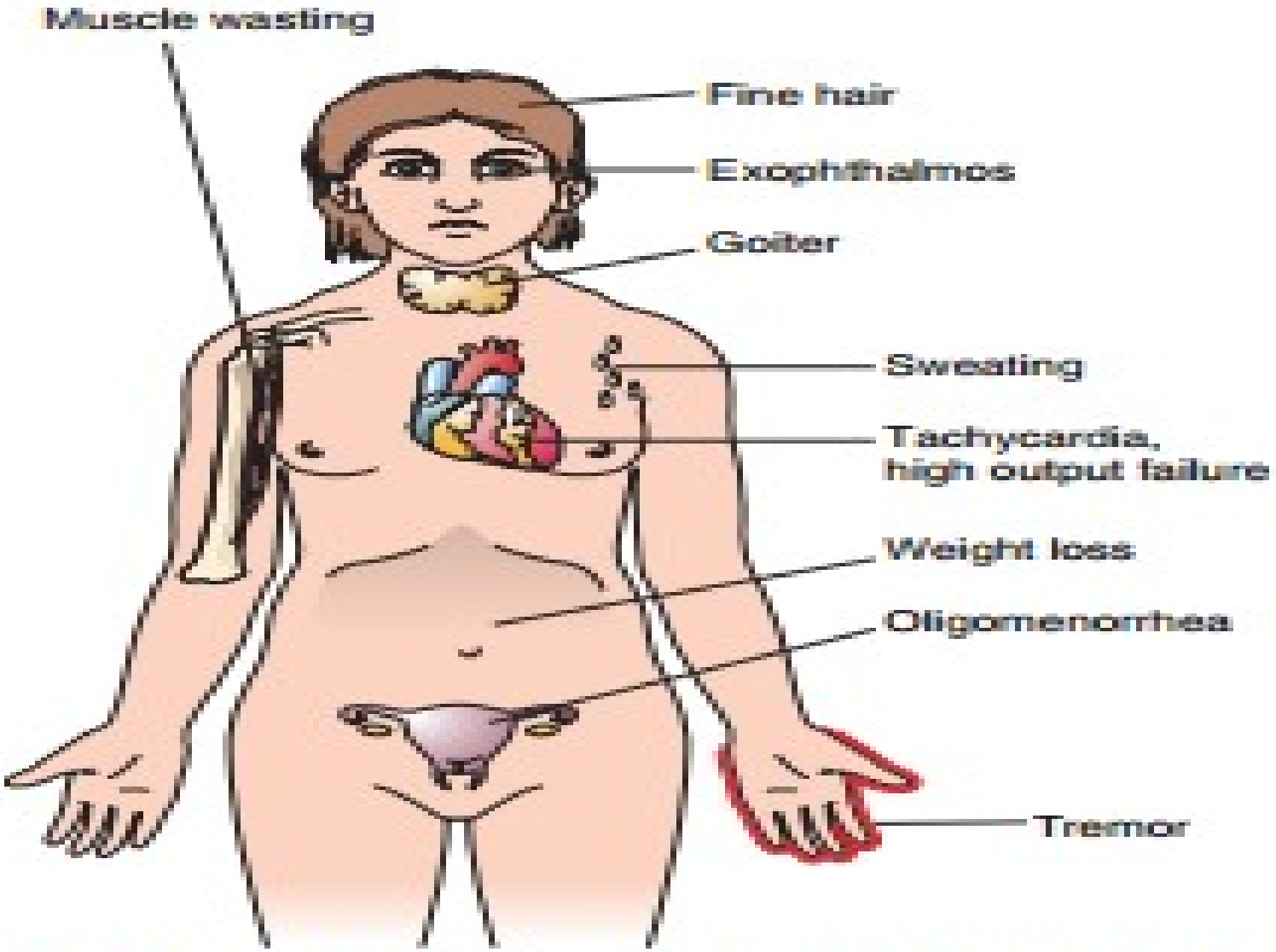
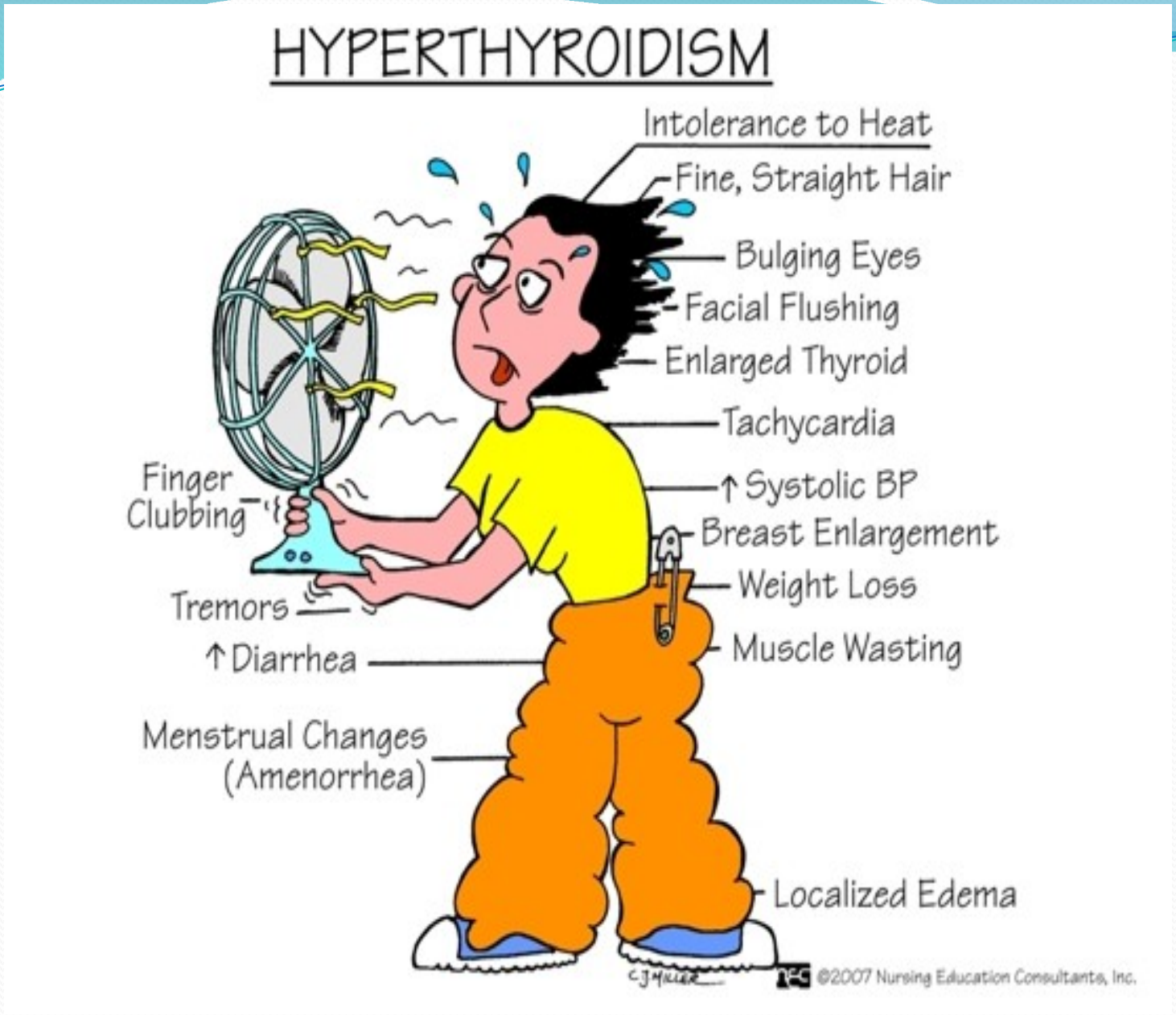
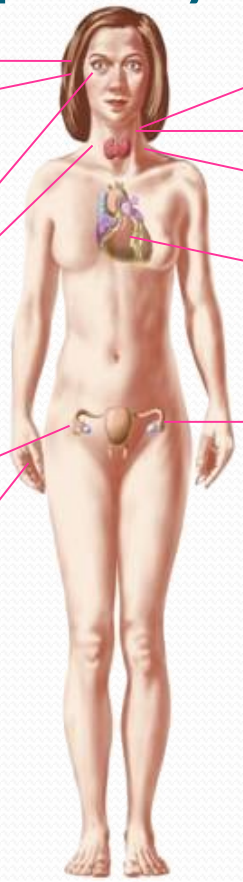



FIGURE 50-4. Clinical manifestations of hyperthyroidism (From Rubin, R., & Strayer, D.S. [2008]. Rubin's pathology: Clinicopathologic foundations of medicine [5th ed.]. Philadelphia: Lippincott Williams & Wilkins.)


HYPERTHYROIDISM
Intolerance to Heat
Fine, Straight Hair
Bulging Eyes
Facial Flushing
Enlarged Thyroid
Tachycardia
↑ Systolic BP
Breast Enlargement
Weight Loss
Muscle Wasting
Localized Edema
Finger Clubbing
Tremors
↑ Diarrhea
Menstrual Changes (Amenorrhea)
©2007 Nursing Education Consultants, Inc.

# Signs and Symptoms of Hyperthyroidism



Nervousness

Irritability

Difficulty Sleeping

Bulging Eyes/Unblinking Stare

Swelling (Goiter)

Menstrual Irregularities or Light Period

Frequent Bowel Movements

Warm, Moist Palms

Excessive Vomiting in Pregnancy

Hoarseness or Deepening of Voice

Persistent Sore or Dry Throat

Difficulty Swallowing

Rapid or Irregular Heartbeat

Infertility

Weight Loss

Heat Intolerance

Increased Sweating

First-Trimester Miscarriage

Family History of Thyroid Disease or Diabetes

## Diagnostic Findings

- The protein bound iodine;
  - Free thyroxine  (FT4),
  - A thyroxin that is not bound to protein;
  - Thyroglobulin; and
  - Serum T3and T4 levels are elevated
- The TSH level is decreased.
- Thyroid ultrasonography shows an enlarged thyroid gland
- A thyroid scan indicates an increased uptake of radioactive iodine (RAI;131Iand 123I) throughout the gland or confined to a single nodule.

# Clinical Exam of Thyroid



# Management

- Appropriate treatment of hyperthyroidism depends on the underlying cause and
- often consists of a combination of therapies, including
  - Antithyroid agents,
  - Radioactive iodine, and
  - Surgery

- **Hypothyroidism**

# Hypothyroidism

- Occurs when the thyroid gland fails to secrete adequate thyroid hormones.
- Thyroid deficiency can affect all body functions and can range from mild, subclinical forms to myxedema
- Common cause of hypothyroidism in adults is
  - Autoimmune thyroiditis (Hashimoto's disease)

## Chart 42-3 • *Causes of Hypothyroidism*

Autoimmune disease (Hashimoto's thyroiditis, post-Graves' disease)
Atrophy of thyroid gland with aging
Therapy for hyperthyroidism
  Radioactive iodine ($^{131}I$)
  Thyroidectomy
Medications
  Lithium
  Iodine compounds
  Antithyroid medications
Radiation to head and neck for treatment of head and neck cancers, lymphoma
Infiltrative diseases of the thyroid (amyloidosis, scleroderma, lymphoma)
Iodine deficiency and iodine excess

## Hypothyroidism…

**Pathophysiology and Etiology**

- Originate in the thyroid (primar hypothyroidism) or
- In the pituitary, in which case insufficient TSH is secreted
- Regardless of the cause, the result of inadequate thyroid hormone secretion is a slowing of all metabolic processes

# Hypothyroidism…

- Severe hypothyroidism is called myxedema
- Advanced, untreated myxedema can progress to myxedemic coma
- Signs of this life-threatening event are
  - hypothermia,
  - hypotension, and
  - hypoventilation
- A client with hypothyroidism experiencing infection, trauma, or excessive chills, or taking narcotics, sedatives, or tranquilizers, can lapse into a myxedemic coma.

## Hypothyroidism…

- If the cause of the thyroid dysfunction is failure of the pituitary gland, the hypothalamus, or both, the hypothyroidism is known as central hypothyroidism.
- If the cause is entirely a pituitary disorder, it may be referred to as pituitary or secondary hypothyroidism.
- If the cause is a disorder of the hypothalamus resulting in inadequate secretion of TSH due to decreased stimulation of TRH, it is referred to as hypothalamic or tertiary hypothyroidism.
- If thyroid deficiency is present at birth, it is referred to as cretinism.
- In such instances, the mother may also have thyroid deficiency.

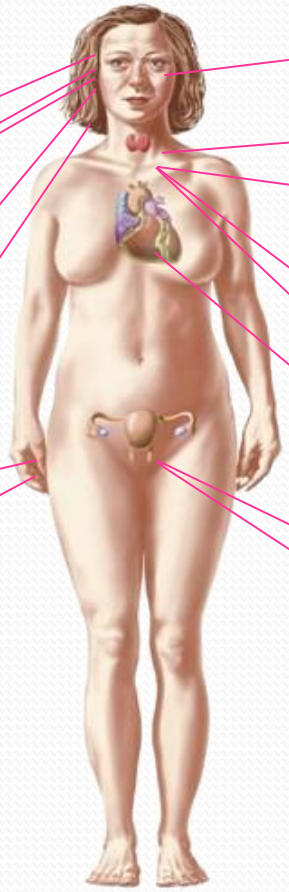
# Clinical Manifestations

- Metabolic rate and physical and mental activity slow down
- The client is lethargic, lacks energy, dozes frequently during the day, is forgetful, and has chronic headaches
- The face takes on a masklike, unemotional expression, yet the client often is irritable
- The tongue may be enlarged and the lips swollen, and there may be edema of the eyelids.
- Temperature and pulse rate are decreased;
- The client is intolerant to cold.

# Clinical Manifestations…

- Weight increases despite a low caloric intake.
- The skin is dry, and hair characteristically is coarse and sparse and tends to fall out
- Menstrual disorders
- Constipation
- The voice is low pitched and hoarse, and speech is slow
- Hearing may be impaired
- The client experience numbness or tingling in the arms or legs that is unrelieved by position change

# Signs and Symptoms of Hypothyroidism



**Tiredness**
**Forgetfulness/Slower Thinking**
**Moodiness/ Irritability**
**Depression**
**Inability to Concentrate**
**Thinning Hair or Hair Loss**
**Loss of Body Hair**
**Dry, Patchy Skin**
**Weight Gain**
**Cold Intolerance**
**Elevated Cholesterol**

**Puffy Eyes**
**Swelling (Goiter)**
**Hoarseness/ Deepening of Voice**
**Persistent Dry or Sore Throat**
**Difficulty Swallowing**
**Slower Heartbeat**
**Menstrual Irregularities/ Heavy Period**
**Infertility**
**Constipation**
**Muscle Weakness or Cramps**

# Diagnostic Findings

- In primary hypothyroidism, levels of TSH are increased because of the negative feedback to the pituitary gland; that is, the low levels of thyroid hormones cause the pituitary gland to increase secretion of TSH
- The level of FT4is decreased.
- The RAI uptake may be decreased.
- The T3 and T4 levels show no response in primary untreated hypothyroidism but may show a response if hypothyroidism results from failure of the pituitary to secrete TSH

# Management

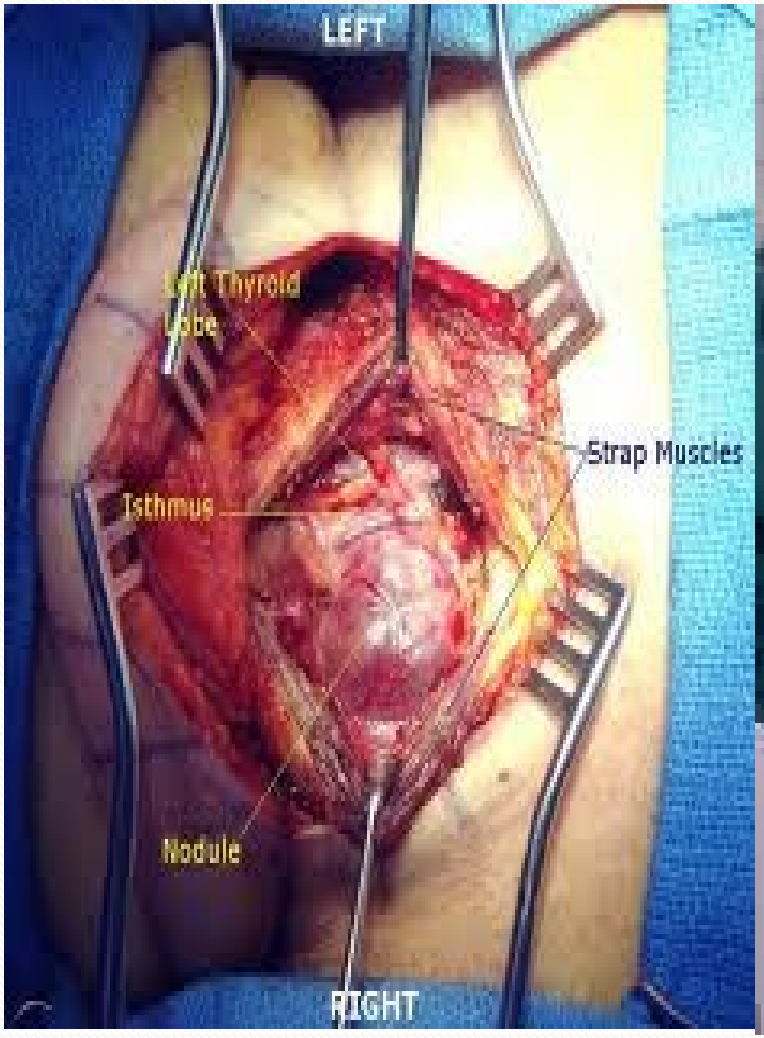
- The primary objective in the management of hypothyroidism is
  - To restore a normal metabolic state by replacing the missing hormone

# Medical Management…

- Treated with thyroid replacement therapy
- Thyroid hormone such as
  - levothyroxine sodium or
  - liothyronine sodium, are orally
- A low dose of thyroid hormone is given initially and then increased or decreased until the optimal dose is achieved

**NURSING ALERT**

- Medications are administered to the patient with hypothyroidism with extreme caution because of
- The potential for altered metabolism and excretion as well as depressed metabolic rate and respiratory status.


LEFT
Left Thyroid Lobe
Strap Muscles
Isthmus
Nodule
RIGHT

