DISORDERS OF THE THYROID GLAND

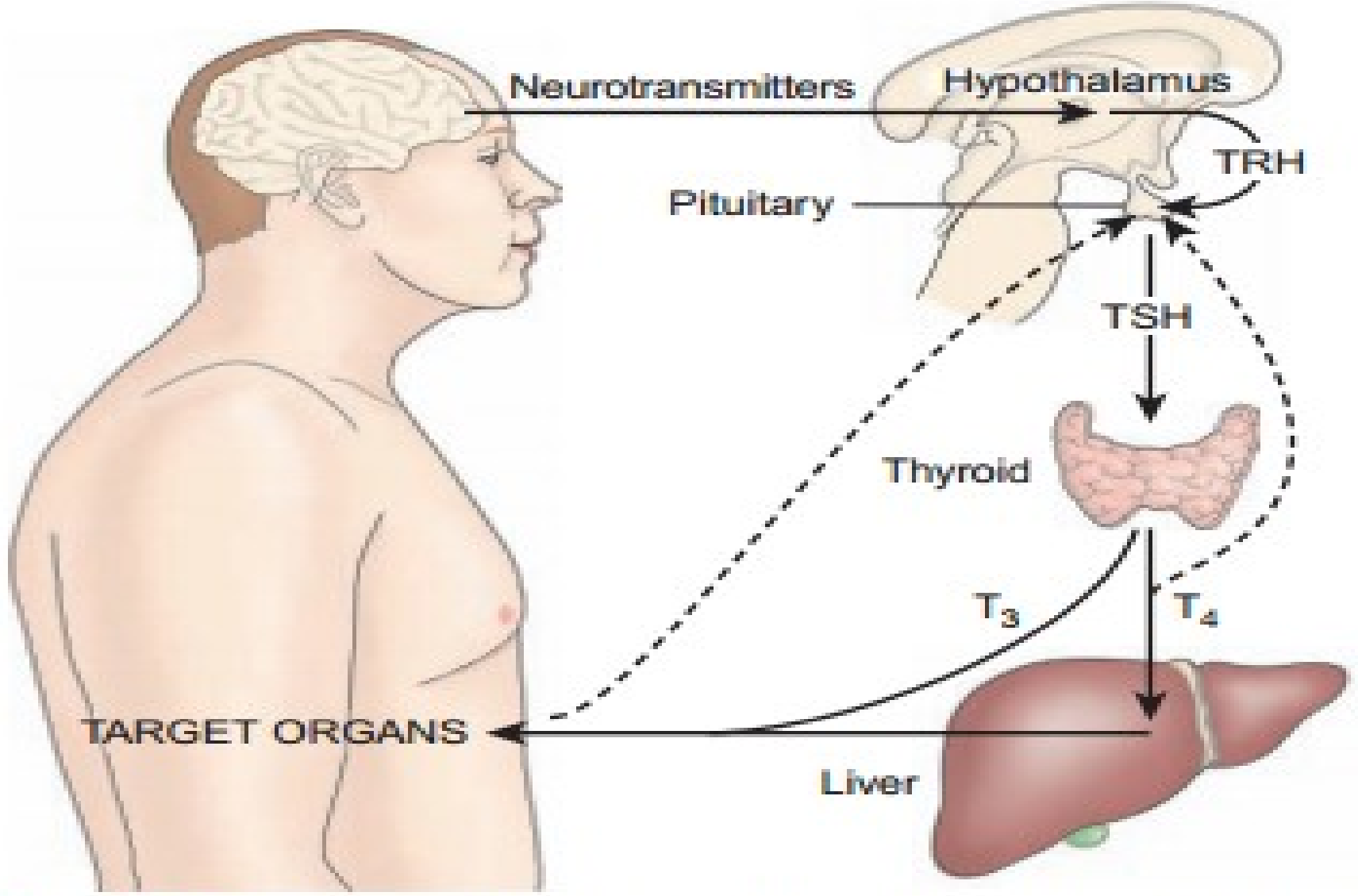
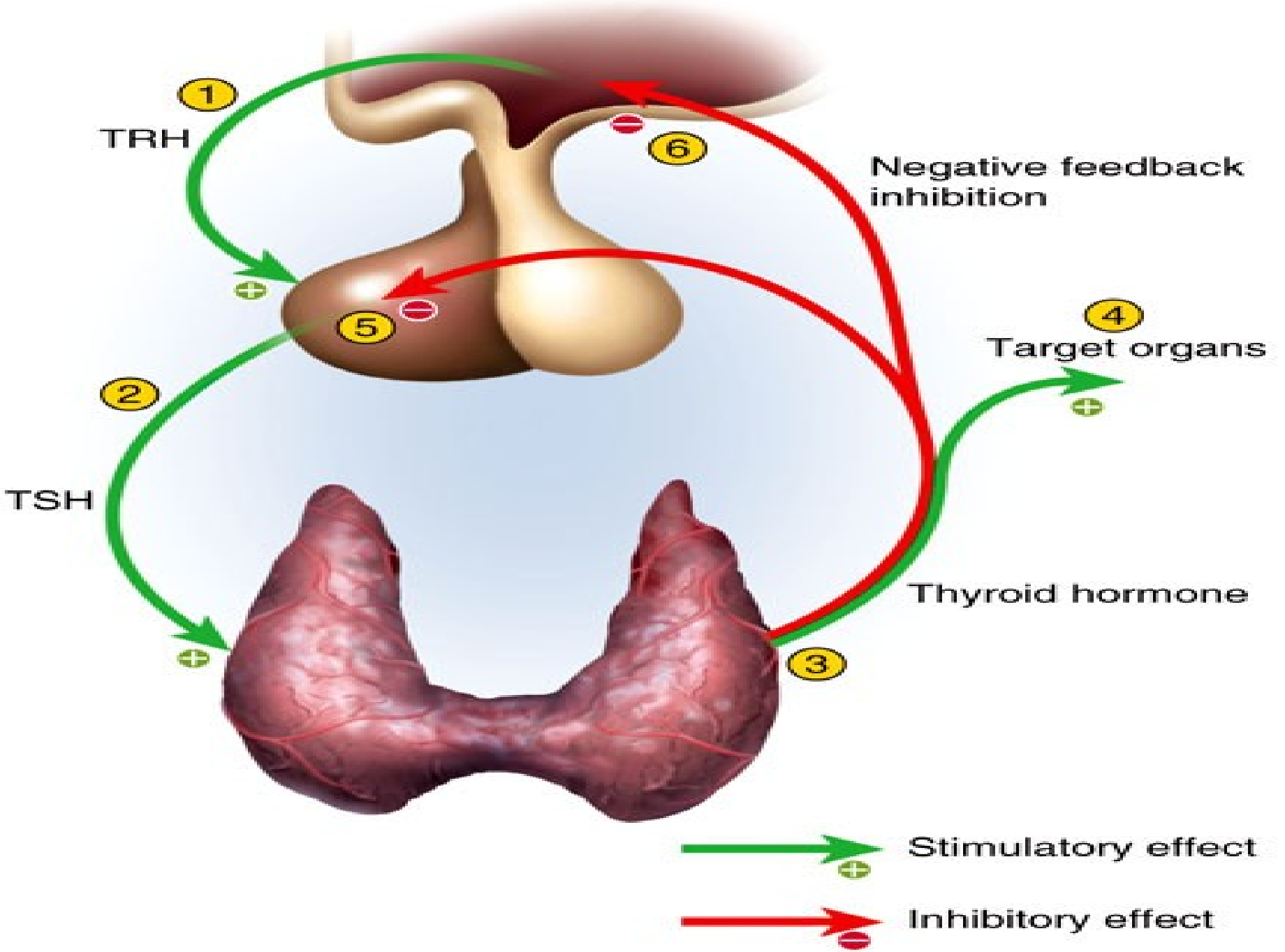


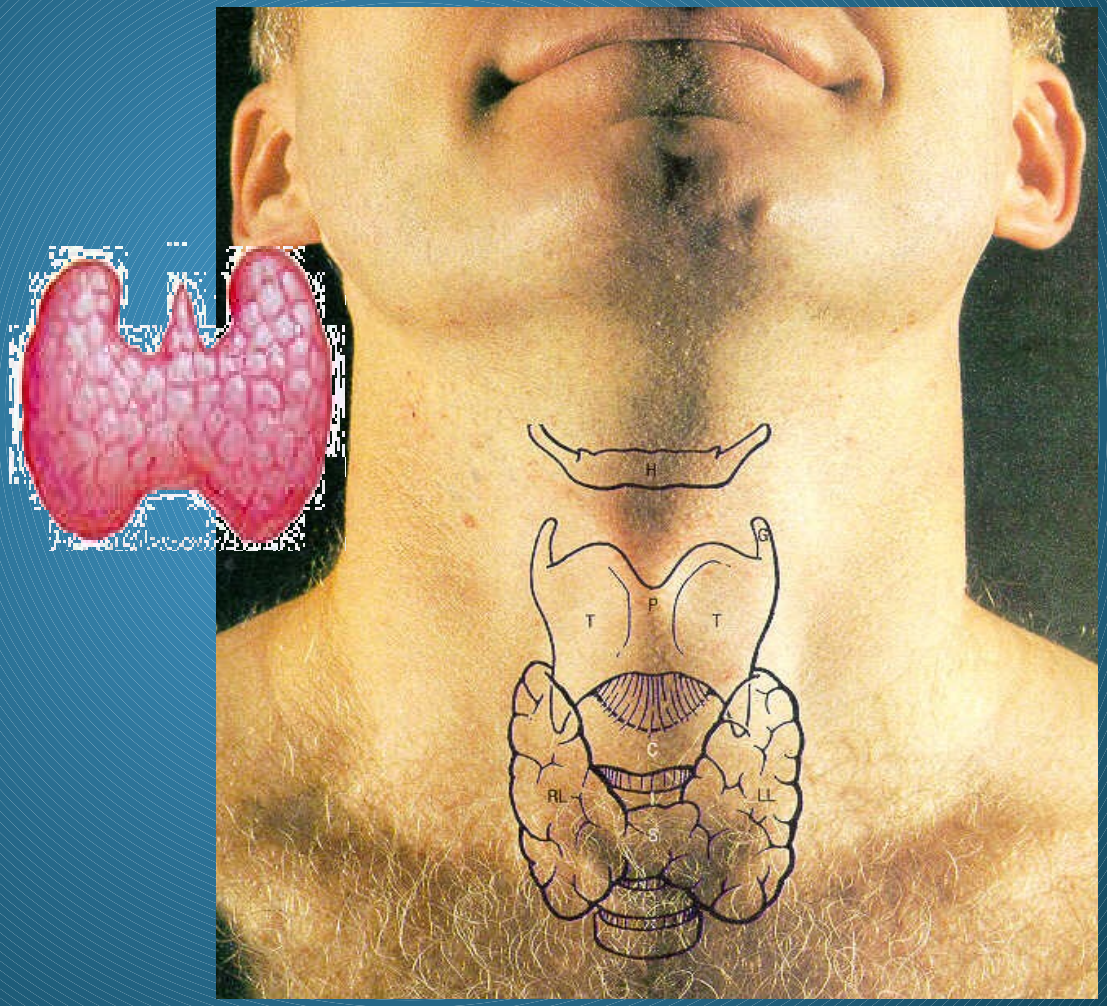
Figure 42-4 The hypothalamic–pituitary–thyroid axis. Thyroid

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Butterfly-shaped organ in front of the neck

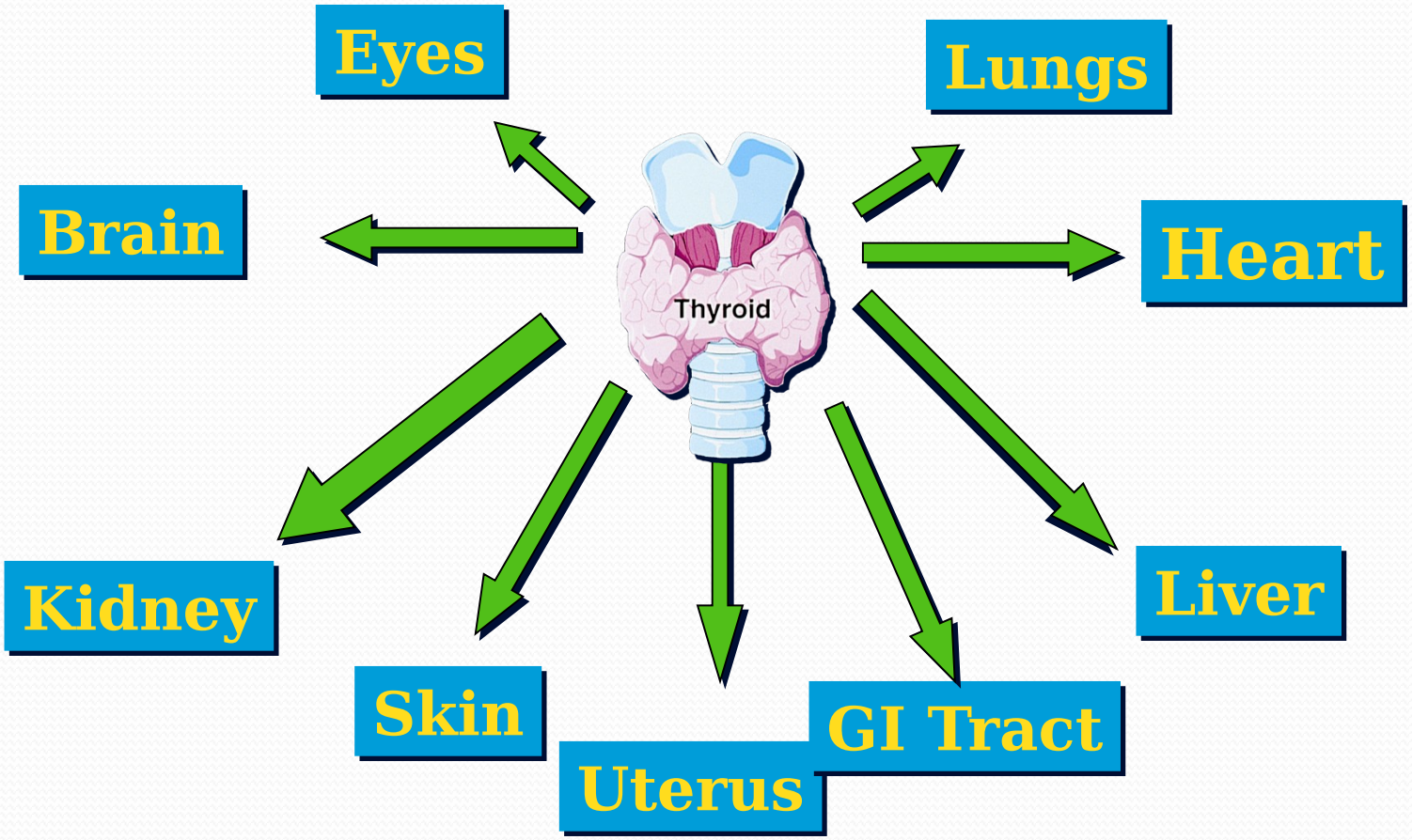
The gland is about 5 cm long and 3 cm wide and weighs about 30 g.

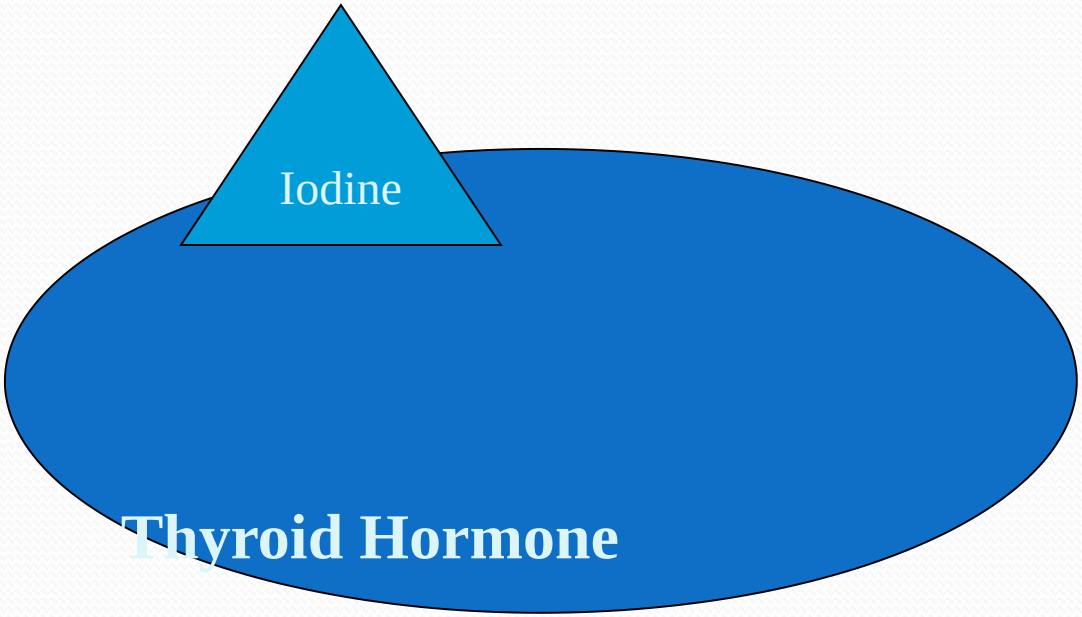


What Does Your Thyroid Gland Do for You?

- 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

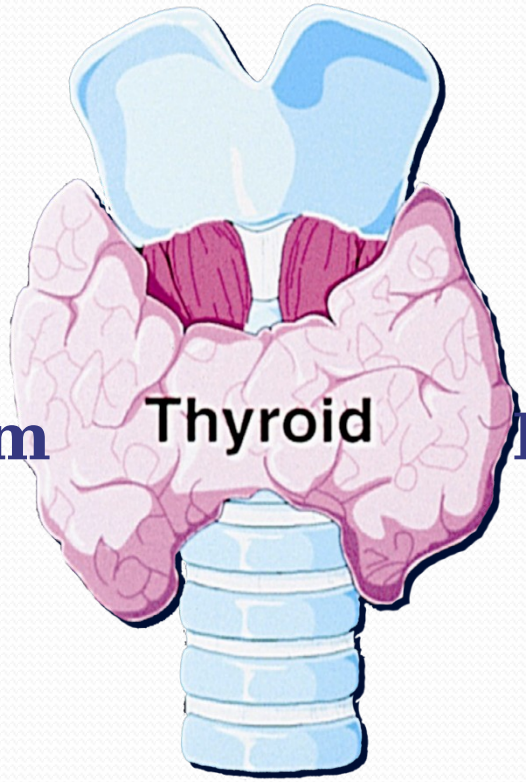




- Brain function, memory, concentration
- Muscle movement
- Cholesterol melting
- Normal heart beat

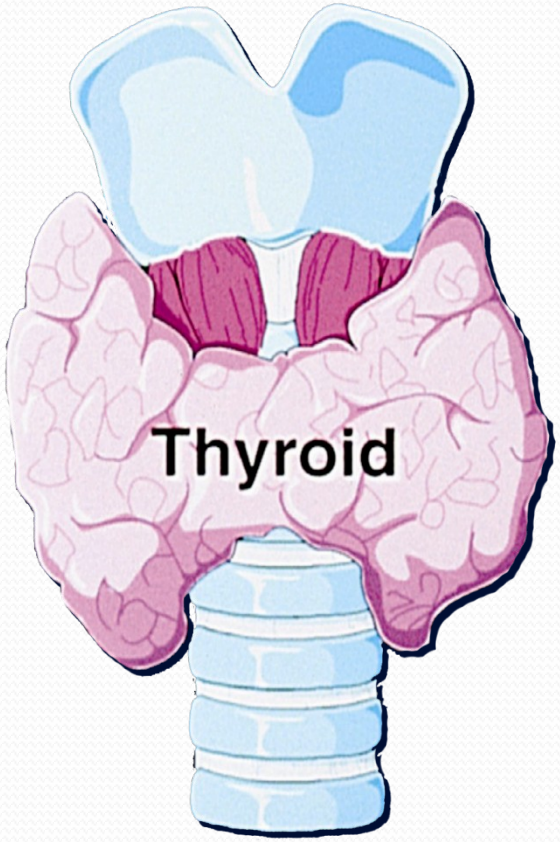
When the Thyroid Doesn't Work

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

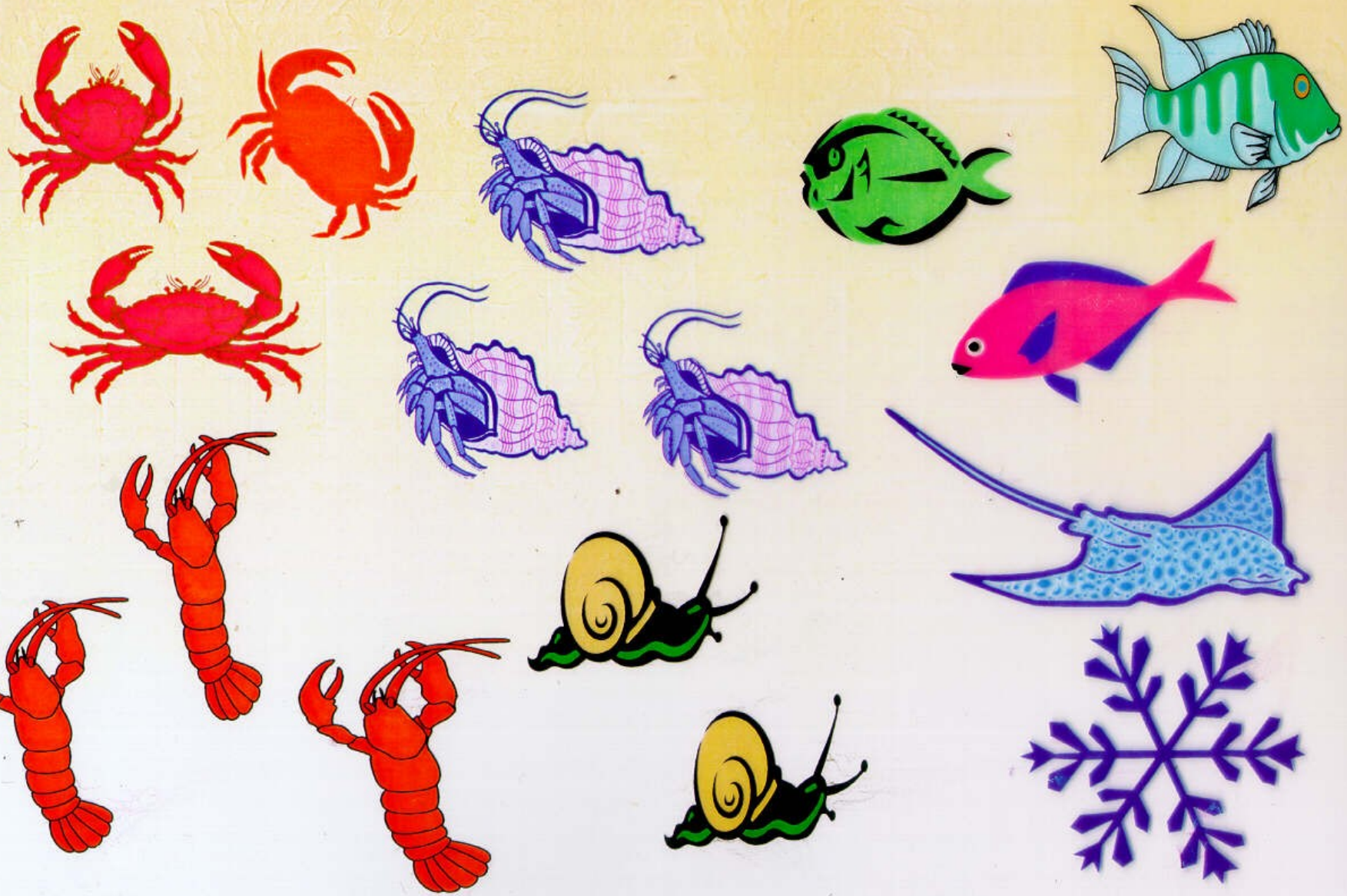
Child & adolescent

- 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…

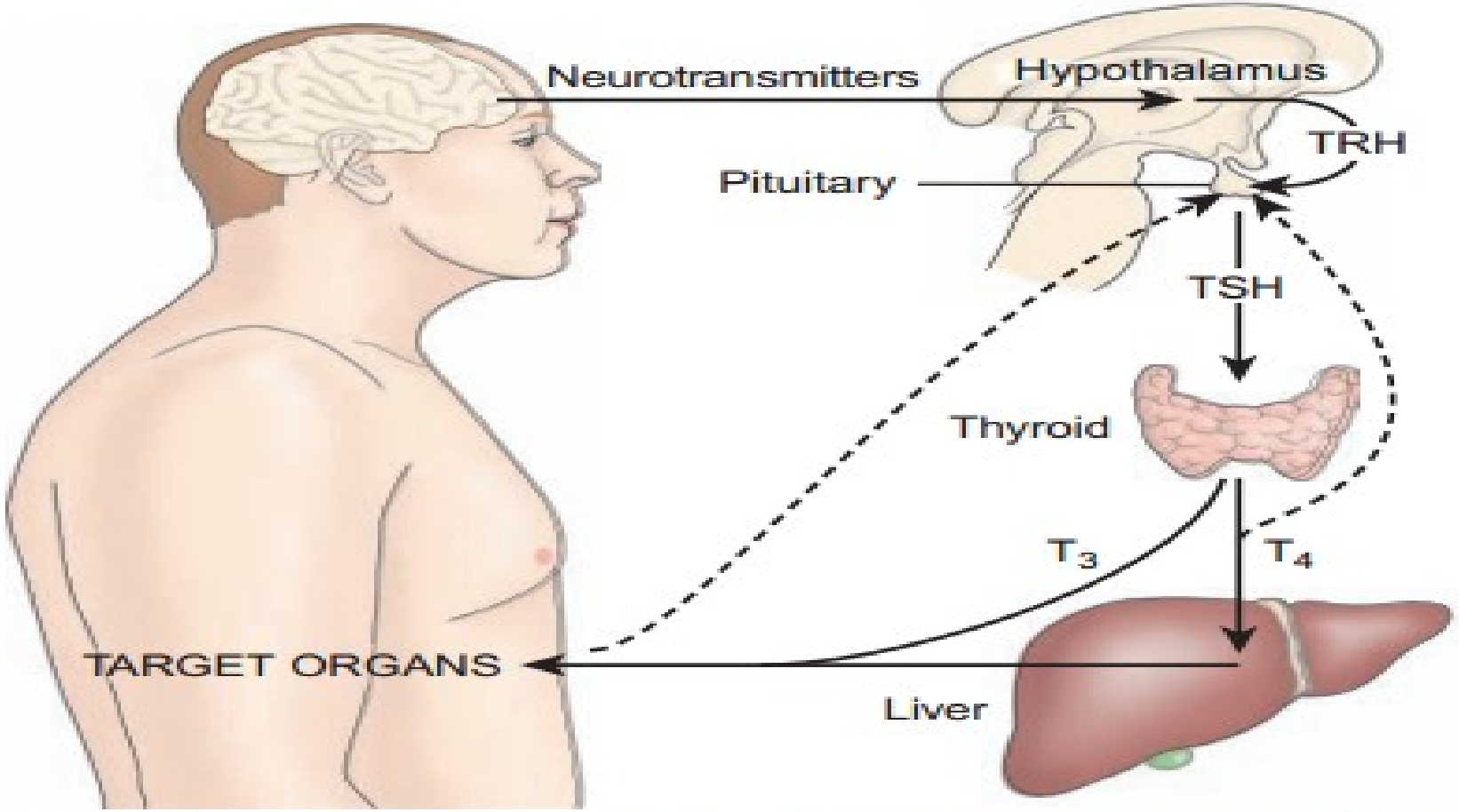


Figure 42-4 The hypothalamic–pituitary–thyroid axis. Thyroid-releasing hormone (TRH) from the hypothalamus stimulates the pituitary gland to secrete thyroid-stimulating hormone (TSH). TSH stimulates the thyroid to produce thyroid hormone (triiodothyronine [T_3] and thyroxine [T_4]). High circulating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

- **HYPERTHYROIDISM**

HYPERTHYROIDISM

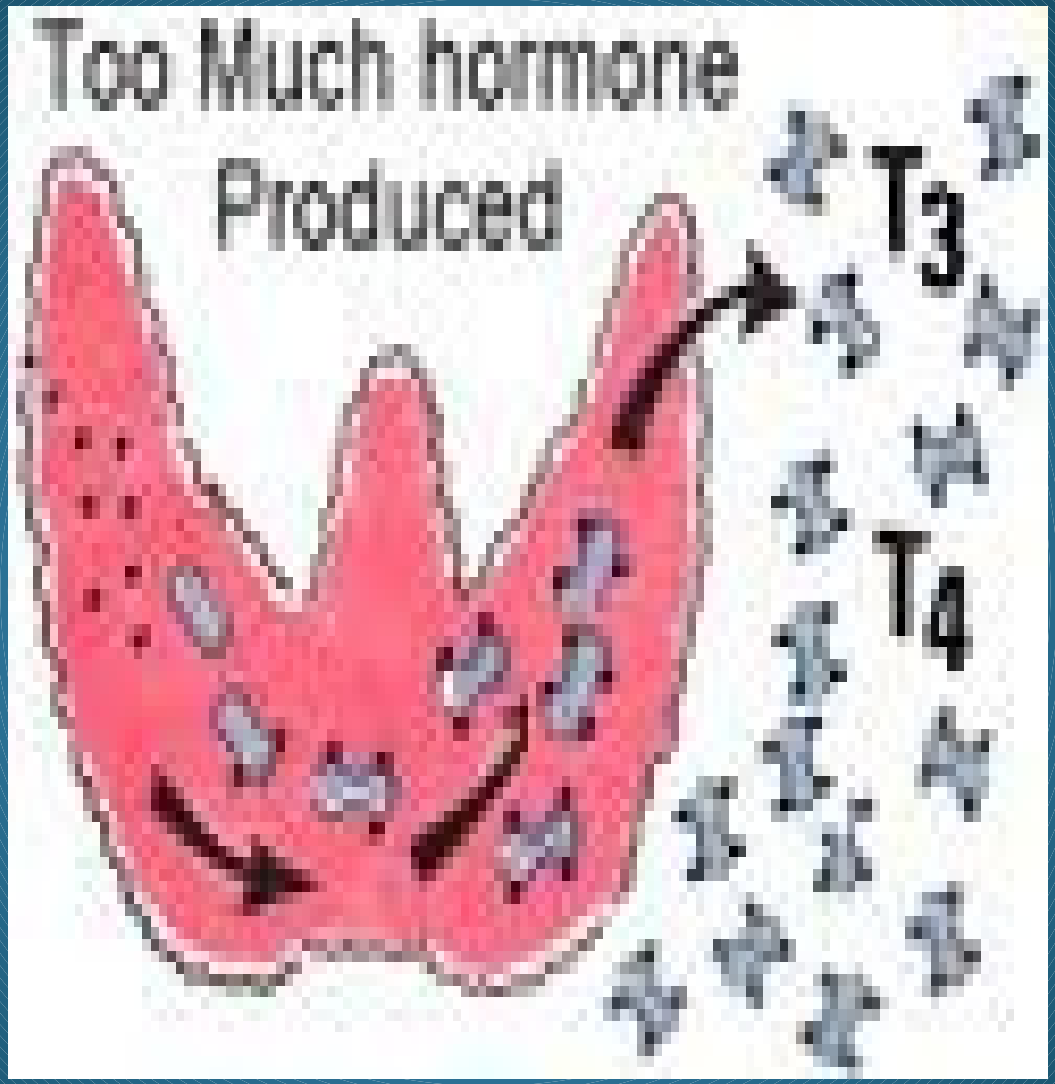
- Is the second most prevalent endocrine disorder, after DM.
- Graves' disease, the most common type of hyperthyroidism, results from an excessive output of thyroid hormones caused by abnormal stimulation of the thyroid gland by circulating immunoglobulin's

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

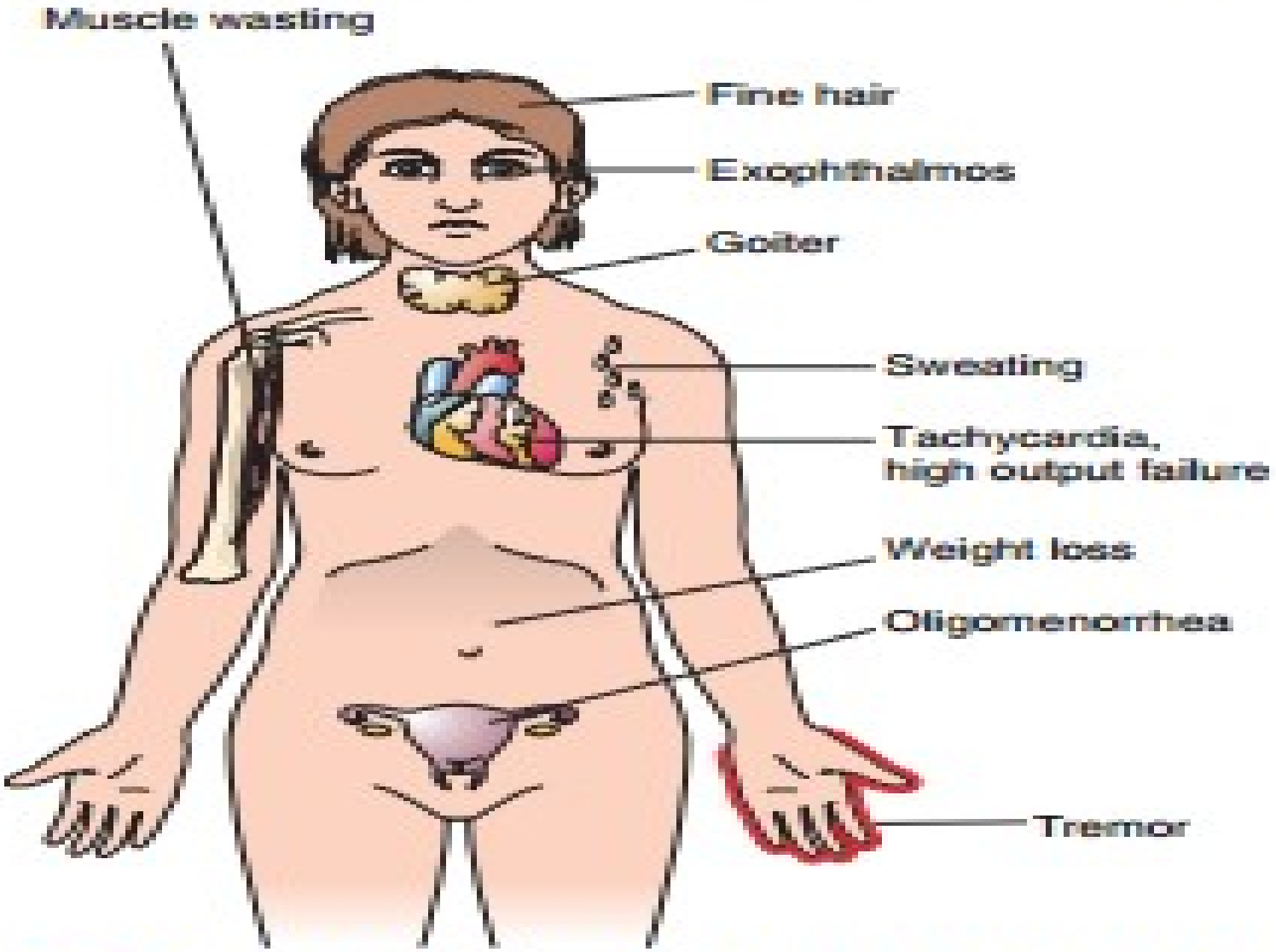
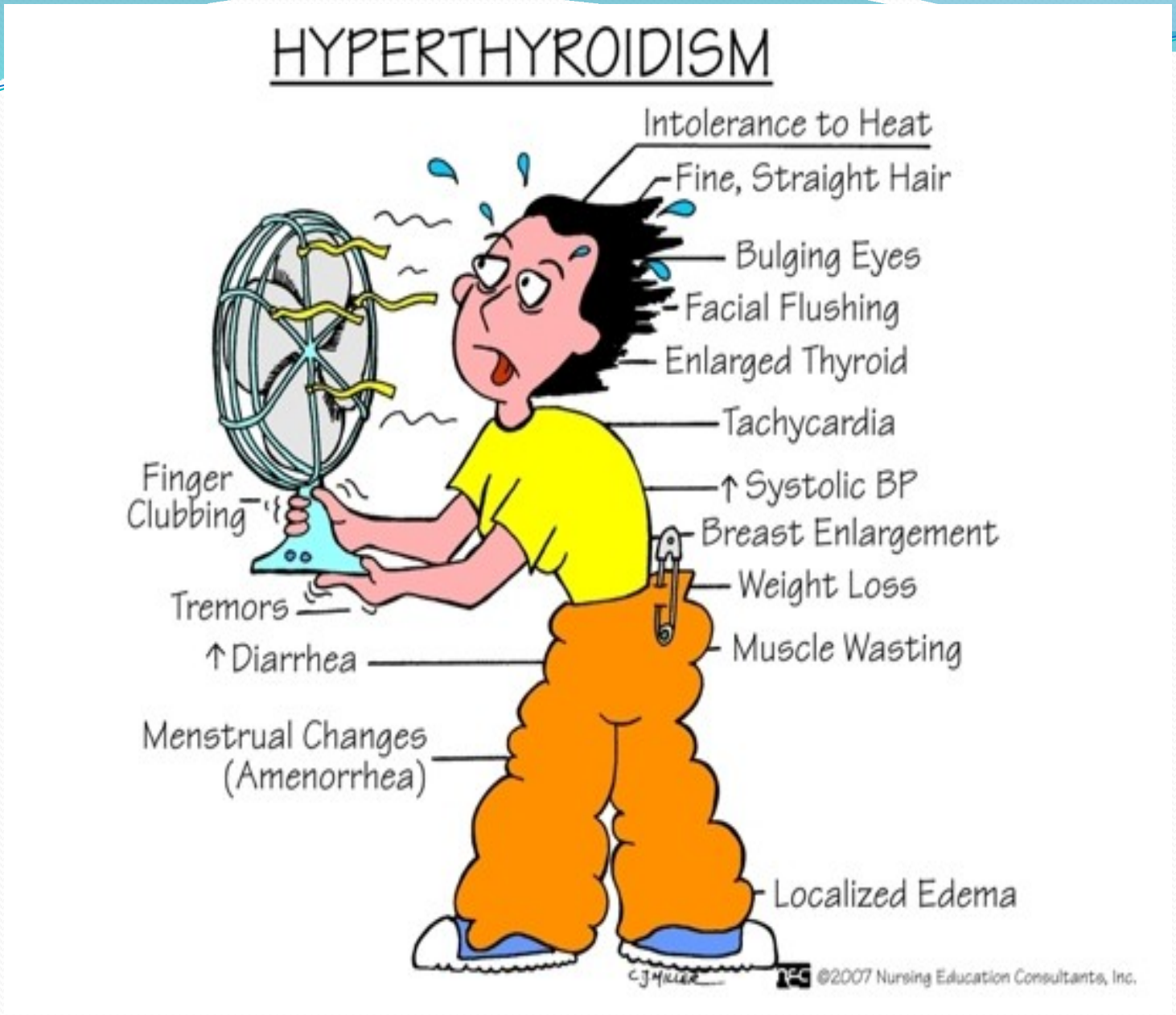
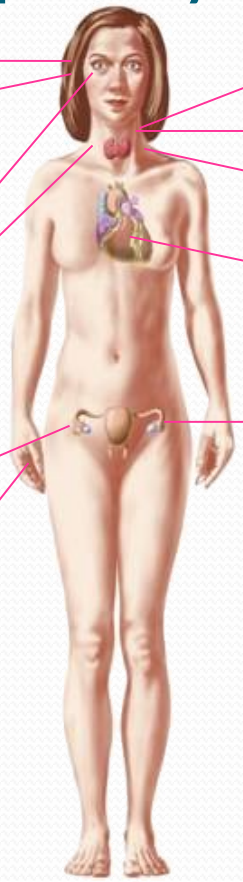


FIGURE 50-4. Clinical manifestations of hyperthyroidism (From Rubin, R., & Strayer, D.S. [2008]. Rubin's pathology: Clinicopathologic foundations of medicine [5th ed.]. Philadelphia: Lippincott Williams & Wilkins.)


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)
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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.

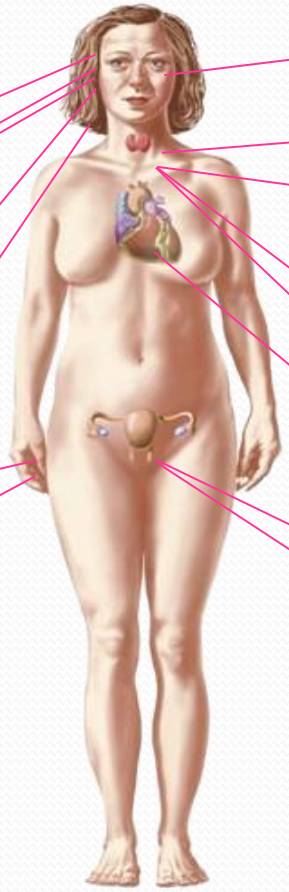
Clinical Manifestations

- 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

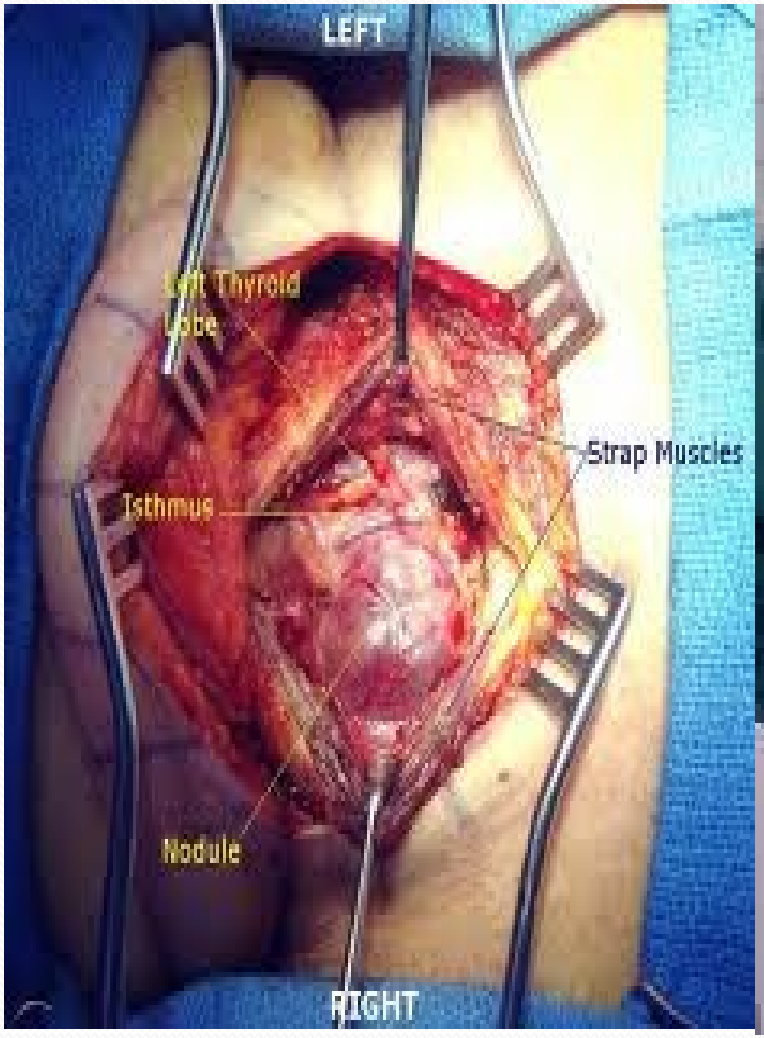
- The primary objective in the management of hypothyroidism is
  - To restore a normal metabolic state by replacing the missing hormone

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

