

# **THYROID GLAND**

**SEM- II, CC IV**

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# **HISTOLOGY OF THE THYROID GLAND**

- **THE THYROID GLAND CONTAINS NUMEROUS FOLLICLES, COMPOSED OF EPITHELIAL FOLLICLE CELLS AND COLLOID.**
- **ALSO, BETWEEN FOLLICLES ARE CLEAR PARAFOLLICULAR CELLS, WHICH PRODUCE CALCITONIN COMPOSED**

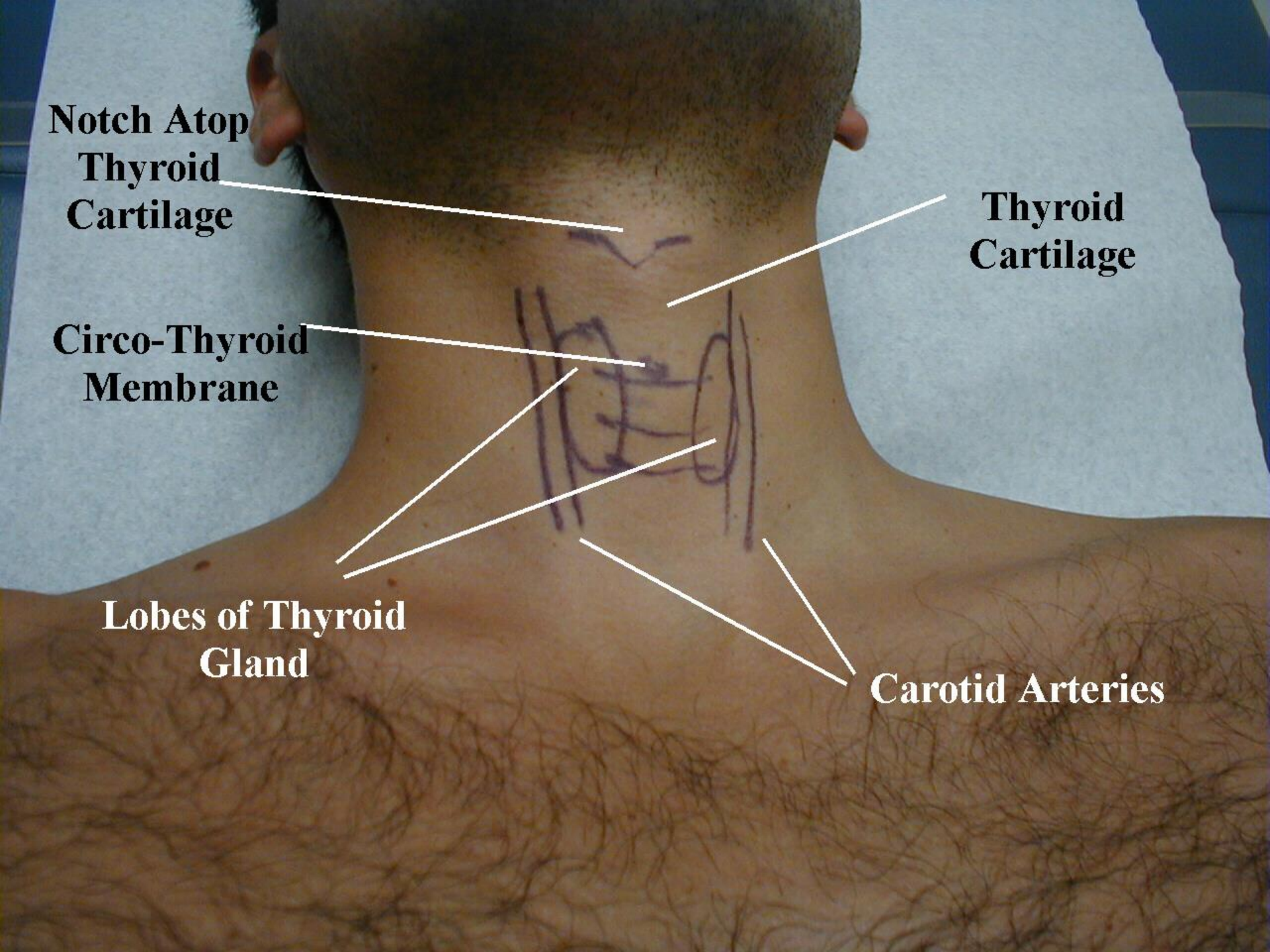
**Notch Atop  
Thyroid  
Cartilage**

**Thyroid  
Cartilage**

**Circo-Thyroid  
Membrane**

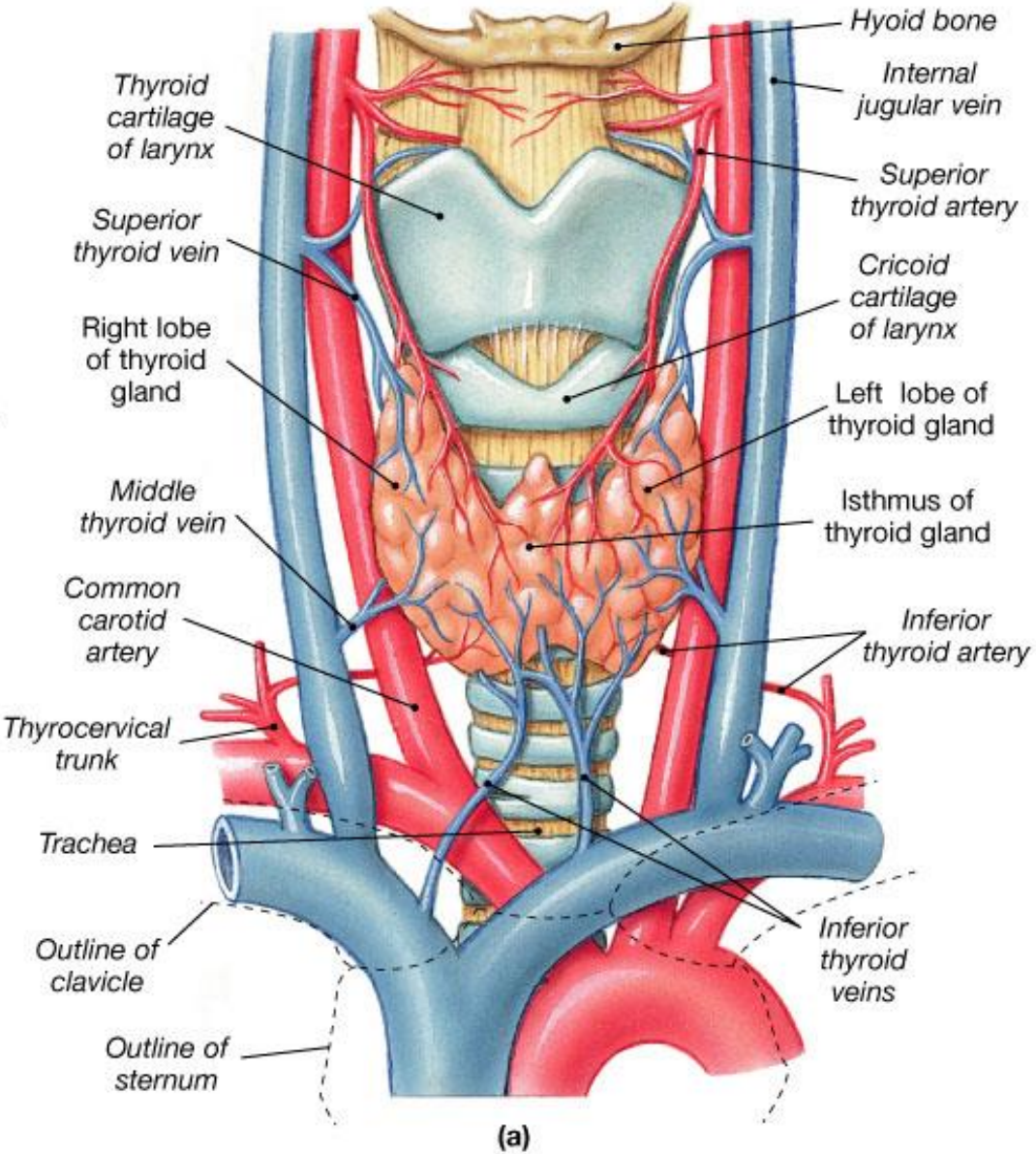
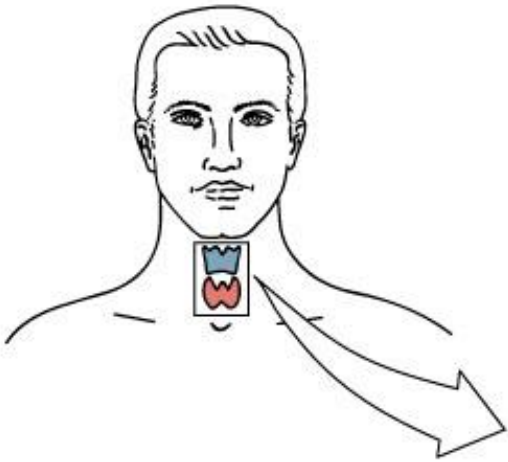
**Lobes of Thyroid  
Gland**

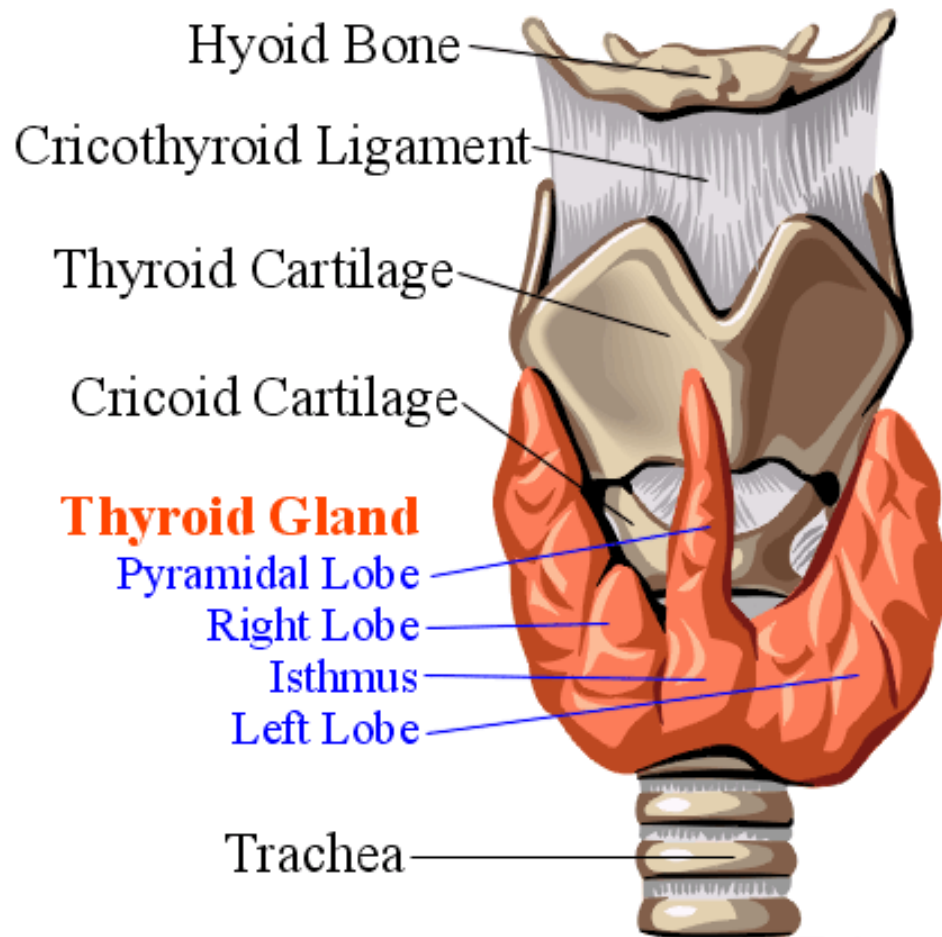
**Carotid Arteries**





# THE THYROID GLAND





*Adapted from Corel Draw 9*

# THYROID HORMONES

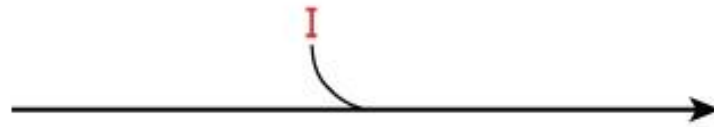
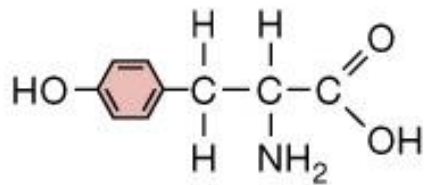
There are two biologically active thyroid hormones:

- **tetraiodothyronine** (T<sub>4</sub>; usually called thyroxine)

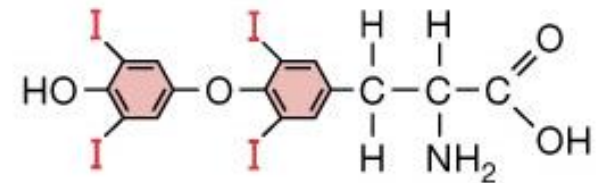
- triiodothyronine (T<sub>3</sub>)

Derived from modification of **tyrosine**.

Tyrosine

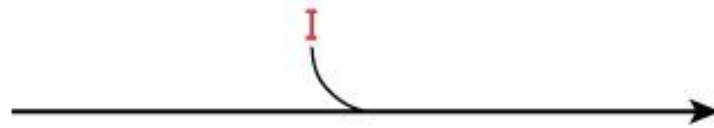
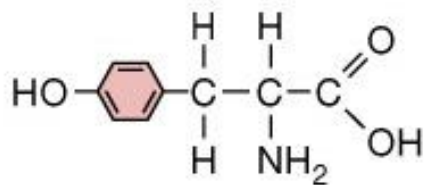


Thyroxine (T<sub>4</sub>)

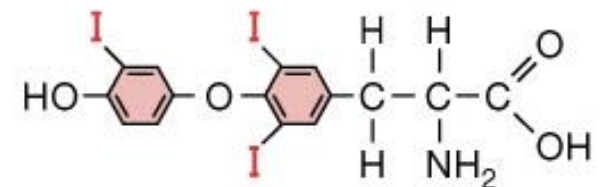


(2 tyrosine + 4 I)

Tyrosine



Triiodothyronine (T<sub>3</sub>)



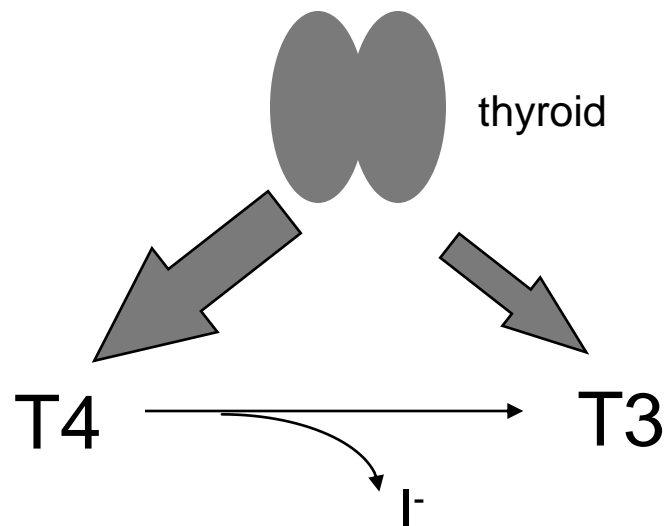
(2 tyrosine + 3 I)

# DIFFERENCES BETWEEN T4 AND T3

The thyroid secretes about 80 microg of **T4**, but only 5 microg of **T3** per day.

However, T3 has a much greater biological activity (about 10 X) than T4.

An additional 25 microg/day of T3 is produced by **peripheral monodeiodination** of T4 (stay tuned....).



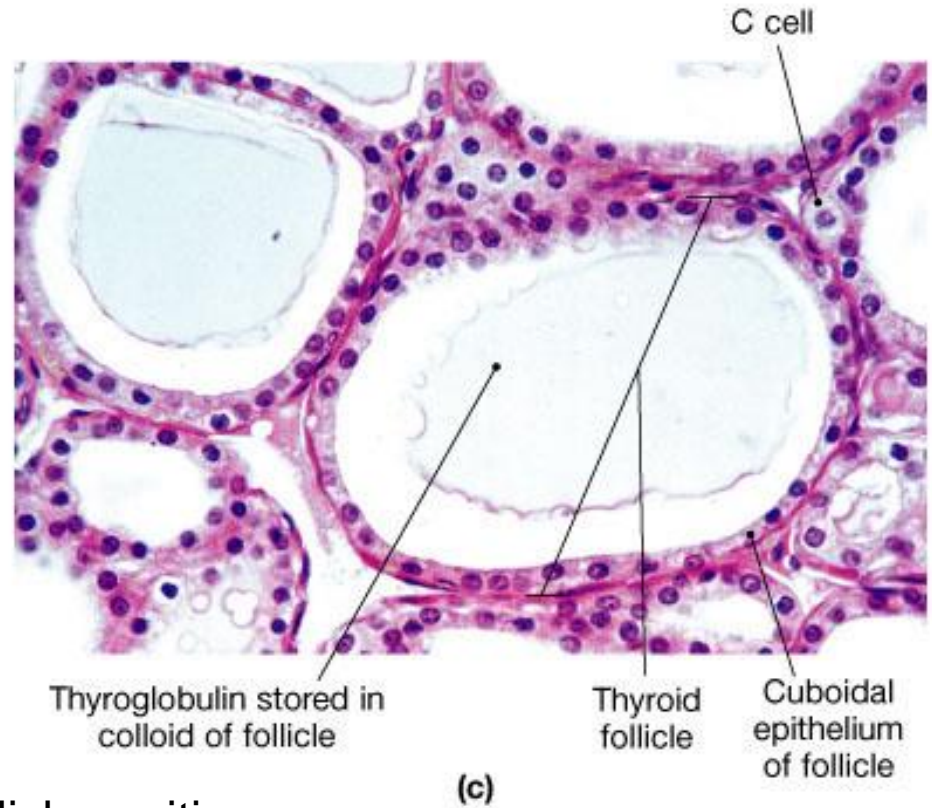
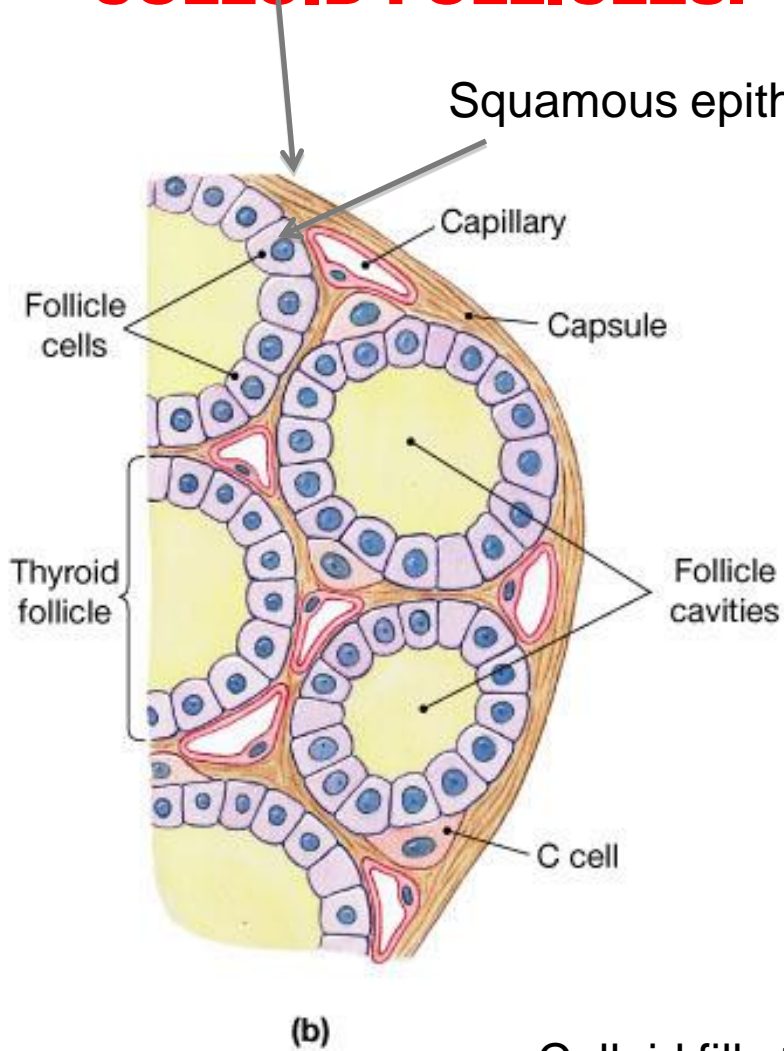
# **WHY IS IODINE IMPORTANT IN THYROID HORMONE PRODUCTION?**

- **Thyroid hormones are unique biological molecules in that they incorporate iodine in their structure.**
- **Thus, adequate iodine intake (diet, water) is required for normal thyroid hormone production.**
- **Major sources of iodine:**
  - **iodized salt**
  - **iodated bread**
  - **dairy products**
  - **shellfish**
- **Minimum requirement: 75 micrograms/day**
- **US intake: 200 - 500 micrograms/day**



# THE THYROID GLAND – HISTOLOGY

GLAND IS COMPOSED OF HOLLOW SPHERES, CALLED COLLOID FOLLICLES.



Colloid fills the follicle cavities

Follicle cells produce thyroglobulin ----→ TH

# ACTIONS OF THYROID HORMONES

Thyroid hormones are essential for **normal growth of tissues**, including the nervous system.

Lack of thyroid hormone during development results in short stature and mental deficits (**cretinism**).

Thyroid hormone stimulates **basal metabolic rate**.

What are the specific actions of thyroid hormone on body systems?

# **ACTIONS OF THYROID HORMONE**

**Required for GH and prolactin production and secretion**

**Required for GH action**

**Increases intestinal glucose reabsorption (glucose transporter)**

**Increases mitochondrial oxidative phosphorylation (ATP production)**

**Increases activity of adrenal medulla (sympathetic; glucose production)**

**Induces enzyme synthesis**

**Result: stimulation of growth of tissues and increased metabolic rate. Increased heat production (calorigenic effect)**

# **EFFECTS OF THYROID HORMONE ON NUTRIENT SOURCES**

- **Effects on protein synthesis and degradation:**
  - increased protein synthesis at low thyroid hormone levels (low metabolic rate; growth)
  - increased protein degradation at high thyroid hormone levels (high metabolic rate; energy)
  
- **Effects on carbohydrates:**
  - low doses of thyroid hormone increase glycogen synthesis (low metabolic rate; storage of energy)
  - **high doses increase glycogen breakdown (high metabolic rate; glucose production)**

# **HORMONES ON THE CARDIOVASCULAR SYSTEM**

**Increase heart rate**

**Increase force of cardiac contractions**

**Increase stroke volume**

**Increase Cardiac output**

**Up-regulate catecholamine receptors**



# **EFFECTS OF THYROID HORMONES ON THE RESPIRATORY SYSTEM**

**Increase resting respiratory rate**

**Increase minute ventilation**

**Increase ventilatory response to hypercapnia and hypoxia**

# **EFFECTS OF THYROID HORMONES ON THE RENAL SYSTEM**

**Increase blood flow**

**Increase glomerular filtration rate**

# **EFFECTS OF THYROID HORMONES ON OXYGEN- CARRYING CAPACITY**

**Increase RBC mass**

**Increase oxygen dissociation from hemoglobin**

# **HORMONES IN GROWTH AND TISSUE DEVELOPMENT**

**Increase growth and maturation of bone**

**Increase tooth development and eruption**

**Increase growth and maturation of  
epidermis, hair follicles and nails**

**Increase rate and force of skeletal muscle  
contraction**

**Inhibits synthesis and increases degradation of  
mucopolysaccharides in subcutaneous tissue**

# **EFFECTS OF THYROID HORMONES ON THE NERVOUS SYSTEM**

**Critical for normal CNS neuronal development**

**Enhances wakefulness and alertness**

**Enhances memory and learning capacity**

**Required for normal emotional tone**

**Increase speed and amplitude of peripheral nerve reflexes**