AC Brown
A6k-a

INTRODUCTION

A. Functional Anatomy

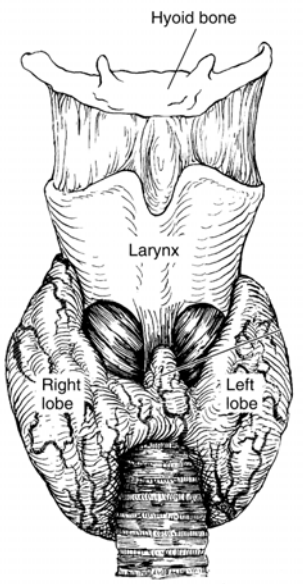
1. "Shield" shaped gland lying over the trachea in the neck

2. Average weight = 20 gm

3. Rich blood supply for its size, 50-100 ml/min

4. Contains 25% of total body iodine

Note: High blood flow required to extract sufficient iodine from the blood



B. Hormones

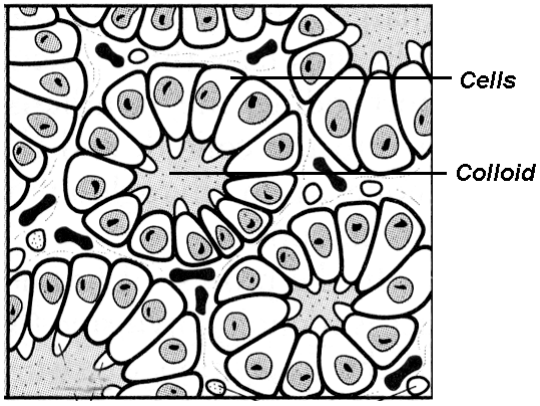
1. "Energy" hormones

   a. Thyroxine, tetraiodothyronine, T4
   b. triiodothhyronine, T3

2. Calcium metabolism hormone: Calcitonin, thyrocalcitonin

HORMONE (T4 & T3) SYNTHESIS AND RELEASE

A. Gland Functional Unit: Thyroid Follicle



HORMONE (T4 & T3) SYNTHESIS AND RELEASE (continued)

B. Synthesis and Storage

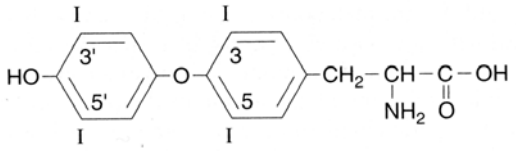
1. Active transport of iodide ion from the interstitial fluid into the cells (the iodide ion taken from the interstitial fluid is replaced from the circulation

2. Diffusion of iodide ion into the colloid center of the follicle

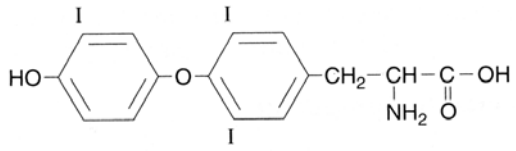
3. Conversion of iodide ion to iodine molecule

4. Binding iodine to globulin-bound thyronine; T4 is formed by thyronine binding 4 atoms of iodine, T3 is formed by thyronine binding 3 atoms of iodine

5. Hormones are stored in the center of the follicle bound to globulin as Thyroglobulin



3,5,3',5',-Tetraiodothyronine (thyroxine, T_4)



3,5,3',-Triiodothyronine (T_3)

C. Hormone Secretion

1. Controlled by TSH (Thyroid Stimulating Hormone, Thyrotropin) released from the anterior pituitary gland and which binds to thyroid gland TSH receptors

2. Effects of TSH on the thyroid gland

   a. increase iodide uptake

   b. increase T4 and T3 synthesis rate

   c. increase release of T4 and T3 into the blood (note: in the blood, T4 and T3 circulate bound to plasma proteins)

   d. thyroid hypertrophy (increase in size) and increased blood flow

   Note: excess stimulation of thyroid TSH receptors causes noticeable thyroid enlargement which can be seen externally; termed goiter

3. Pituitary TSH release controlled by TRH (Thyroid Releasing Hormone) release from the pituitary

THYROID HORMONE ACTIONS

A. Effects on many of the body organs and tissues

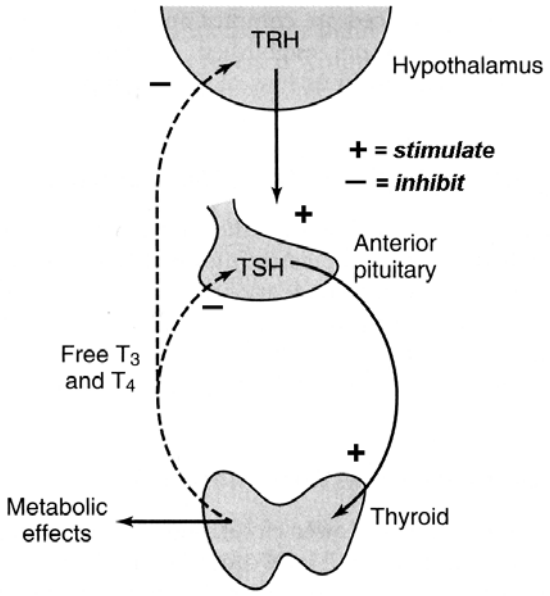
	Hyperthyroid	Hypothyroid
METABOLIC		
Increase oxygen consumption Increase metabolic rate	BMR ⇑	BMR ⇓
Increase body heat production and temperature	Core T ⇑, sweating	Core T ⇓
Increase gastrointestinal absorption efficiency		Can lead to anemia due to low vitamin B12 transport
Increased cardiac output (HR ⇑, contractility ⇑	High; can lead to high output heart failure	Low
Stimulate adipose (fat) tissue lipid turnover; stimulate muscle protein turnover		
NERVOUS SYSTEM		
Essential for normal brain development		Cretinism
Nervous system excitability	Irritable, restless	Slow dull
GROWTH		
Essential for normal growth and skeletal maturation		Dwarfism

BMR: Basal Metabolic Rate; total body metabolic rate measured in standardized circumstances – relaxed, awake, postabsorbtive, in comfortable conditions

B. Time Course: relatively slow response, with the effects of thyroid hormone concentration change requiring a 7-10 days to be fully exhibited

THYROID HORMONE REGULATION

A. Mechanism: Long loop negative feedback from T4 & T3 on the pituitary TSH release and hypothalamic TSH release



PATHOPHYSIOLOGY (Examples)

A. Iodine Deficiency Hypothyroidism

1. Cause: lack of iodine in the diet

2. Results

a. goiter
b. low BMR
c. myxedema (due to changes in subcutaneous connective tissue)
d. slow mentation
e. reduced growth (cretin)
f. high plasma TSH

B. Grave's Disease

1. Cause: production of an immune-associated globulin that acts like TSH

2. Results

a. goiter
b. high BMR
c. exopthalmos (bulging eyes)
d. nervousness
e. weight loss
f. increased cardiac output
g. plasma TSH low

Note: Treatment can involve surgical removal of part of the thyroid gland or administration of radioactive iodine to destroy thyroid cells