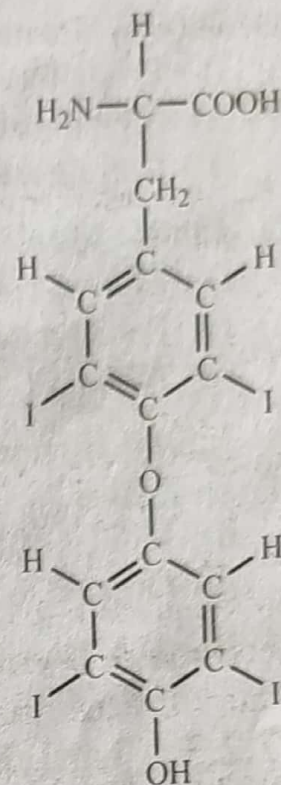


27.1. THYROXINE

27.1.1. Introduction

Thyroxine (also known by the names of 3,5,3',5'-tetraiodothyronine or T₄) is one of the two main hormones secreted by the thyroid gland (the other is triiodothyronine). Its main function is to stimulate the utilisation of oxygen and hence the metabolism of all cells and tissues of the body. Thyroxine is produced by the addition of iodine to amino acid tyrosine at molecular level, while the latter one is bound to the protein thyroglobulin. Extreme secretion of thyroxine in the body is known as hyperthyroidism and its reduced secretion is known as hypothyroidism.



Thyroxine (Thy)

27.1.2. Mechanism of Action

Thyroid hormones enter the cells via membrane transporter proteins. Out of many recognised plasma membrane transporters, some of them need ATP hydrolysis. The comparative significance of various carrier systems is not yet known and may change between tissues.

The hormone binds to its receptor after entering the nucleus and the hormone-receptor complex acts on the specific DNA sequences in the promoters of responsive genes. The binding of **hormone-receptor complex with DNA modulates gene expression** either by stimulation or inhibition of transcription of specific genes.

Cardiac contractility partially depends on the relative ratio of various myosin proteins in cardiac muscles. Thyroid hormones stimulate the transcription of some myosin genes, while inhibit the transcription of others. The overall effect alters the ratio towards increased contractility.

27.1.3. Uses

Thyroid hormones are used as a replacement therapy in the following deficiency states:

- 1) Cretinism,
- 2) Adult hypothyroidism,
- 3) Myxoedema coma,
- 4) Non-toxic goitre,
- 5) Thyroid nodule, and
- 6) Papillary carcinoma of thyroid.

27.2. ANTI-THYROID DRUGS

27.2.1. Introduction

Anti-thyroid drugs are antagonists which act against the thyroid hormones. The main anti-thyroid agents include carbimazole, methimazole, and propylthiouracil. An unusual anti-thyroid agent is potassium perchlorate.

27.2.2. Classification

Anti-thyroid drugs can be classified as follows:

- 1) **Inhibit Hormone Synthesis (Anti-Thyroid Drugs)**
 - i) Propylthiouracil,
 - ii) Methimazole, and
 - iii) Carbimazole.
- 2) **Inhibit Iodide Trapping (Ionic Inhibitors)**
 - i) Thiocyanates ($-\text{SCN}$),
 - ii) Perchlorates ($-\text{ClO}_4$), and
 - iii) Nitrates ($-\text{NO}_3$).
- 3) **Inhibit Hormone Release**
 - i) Iodine,
 - ii) Iodides of Na and K, and
 - iii) Organic iodide.
- 4) **Destroy Thyroid Tissue:** Radioactive iodine (^{131}I , ^{125}I , and ^{123}I).

27.2.3. Individual Compounds

The following drugs are studied in detail:

- 1) Methimazole,
- 2) Methylthiouracil, and
- 3) Propylthiouracil.