terial of his own thyroid. Some of the TSIs have much longer biological half-lives than thyrotropin and are also called longacting thyroid stimulators (LATSs).

Apart from hyperthyroidism evoked by thyrotropin or TSI, other forms of hyperthyroidism are recognised, for example hyperthyroidism associated with multinodular goitre, a solitary hyperactive adenoma (benign tumour) of the thyroid and excess exogenous thyroid hormone. In multinodular goitre one or more of the nodules may become hyperactive (Plummer's disease). Control of hormone secretion by negative feedback does not apply for hyperfunctioning nodules or adenomas. In only a small percentage of patients does thyroid carcinomatous tissue produce thyroid hormone.

Thyroid function tests. Tests used to assess the functional status of the thyroid quantitatively include determining the plasma levels of T_3, free T_4 and TT, the uptake of ^{131}I, etc. Scintigraphy of the thyroid, using ^{99}Tcm or ^{131}I, supplies valuable information about the anatomy of the gland.

Graves' disease may be treated by antithyroid drugs, surgery, or high doses of ^{131}I — radioactive iodine is probably the treatment of choice in adults. Over the short term a β-blocker, for example propranolol, may be used to reduce nervousness, anxiety and basal metabolic rate.

Use of thyroid hormones by euthyroid individuals to promote weight loss or counteract fatigue is not advised.

SUMMARY: thyroid gland

Organisation

The thyroid
- orginates embryonically from the base of the tongue
- consists of two lobes joined by an isthmus anteriorly across trachea
- is constructed of follicles (layer of cells around a fair-sized lumen)
- has a very rich blood supply
- produces two types of hormones
  - iodothyronines
  - calcitonin (see p 18.28)

Thyroid hormones: iodothyronines

Biosynthesis of T_4 and T_3
- Thyroid synthesises two important iodothyronine hormones: T_4 and T_3
- Two nutrients are required for iodothyronine synthesis: iodine and tyrosine
- Iodine is actively taken up as iodide by the follicular cells
- Iodide is intracellularly oxidised to iodine and transferred to follicular lumen
- Tyrosine residues of thyroglobulin are iodinated at C_3 and C_5 to form MIT and DIT
- MIT and DIT couple (conjugate) to form tri- and tetraiodothyronine (T_3 and T_4)
- Thyroglobulin is endocytosed and cleaved to release T_3 and T_4
- T_3 and T_4 diffuse to the blood where ≈ 99 % binds to plasma proteins
- T_4 makes up ≈ 95 % of the circulating hormones and acts as prohormone to T_3
- Some T_3 is formed within the thyroid but most is formed peripherally (liver, etc.)
- T_3 has a shorter t½ than T_4 and is more potent than T_4
- All stages of hormosynthesis are controlled by thyrotropin
- Release of thyrotropin controlled by thyroliberin and circulating T_3 and T_4

Actions of T_4 and T_3
- Stimulate metabolism of most cells — anterior pituitary an exception
- Increase demand for O_2 and raise BMR
- Stimulate protein anabolism or catabolism, depending on concentration
- Promote glucose absorption and catabolism
- Stimulate lipolysis and catabolism of lipids
- Stimulate vitamin metabolism and increase vitamin requirements
- Increase heart rate, vasodiameter and bloodflow rate
- Stimulate growth and maturation — including the brain

Derangement of thyroid function

Simple goitre (endemic goitre)
- Thyroid enlarged without clear signs of hypothyroidism
- Gland enlarges due to increase in thyrotropin secretion
- Common causes are iodine deficiency and goitrogens — often endemic