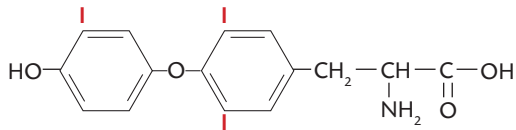


**a** Thyroxine ( $T_4$ )



**b** Triiodothyronine ( $T_3$ )

residue forms monoiodotyrosine (MIT), while addition of two iodines to the same tyrosine residue forms diiodotyrosine (DIT). Thyroglobulin is then released into the follicular lumen. The final step in hormone synthesis is the coupling of iodinated tyrosine residues by covalent bonds. If two DIT residues combine, tetraiodothyronine (thyroxine, or  $T_4$ ) is formed, while triiodothyronine ( $T_3$ ) is formed when a DIT and a MIT combine. Coupling does not occur between two MIT molecules. Thyroxine and triiodothyronine are the thyroid hormones, but at this point, they are still attached to thyroglobulin. Normally, only 10 % of the tyrosine molecules in thyroglobulin become iodinated. The colloid contains enough thyroid hormone for 2–3 months.

### Secretion and transport of thyroid hormones

When the follicular cells are stimulated by TSH, they take up iodinated thyroglobulin molecules

**Figure 6.14** Synthesis and secretion of thyroid hormones. Iodide is taken up by the follicular cells by active transport through the basal membrane (1). In the apical membrane, iodide is oxidized to atomic iodine ( $I^0$ ) by the enzyme thyroperoxidase (TPO).  $T_4$  and  $T_3$  are formed by iodination of tyrosine in thyroglobulin (2). During secretion, small colloid-containing vesicles are taken up by the follicular cells from the follicular lumen (3). Thyroid hormones are released from thyroglobulin by lysosomal enzymes (4). The free hormones then diffuse out of the cells (5) into the tissue fluid and are transported throughout the body via blood, mostly bound to thyroid-binding globulin (6).

**Figure 6.13** Chemical structure of (a) thyroxine ( $T_4$ ) and (b) triiodothyronine ( $T_3$ ). Iodine atoms are shown in red.

by endocytosis. Within the epithelial cells,  $T_3$  and  $T_4$  are released from thyroglobulin by the actions of lysosomal enzymes (Fig. 6.14). Since  $T_3$  and  $T_4$  are lipid-soluble, they diffuse out of the epithelial cell and into the blood capillaries, where 70–80 % binds selectively to thyroxine-binding globulin (TBG), while the remaining portion binds nonspecifically to albumin.

$T_4$  is the main product of the thyroid gland, and the concentration of  $T_4$  in plasma is 50–60 times higher than the concentration of  $T_3$ . The free, biologically active component of thyroid hormone in plasma is only 0.03 % of the total

The colloid contains a store of thyroid hormones

Thyroid hormones are bound to plasma proteins

$T_4$  is the main hormonal product of the thyroid gland

