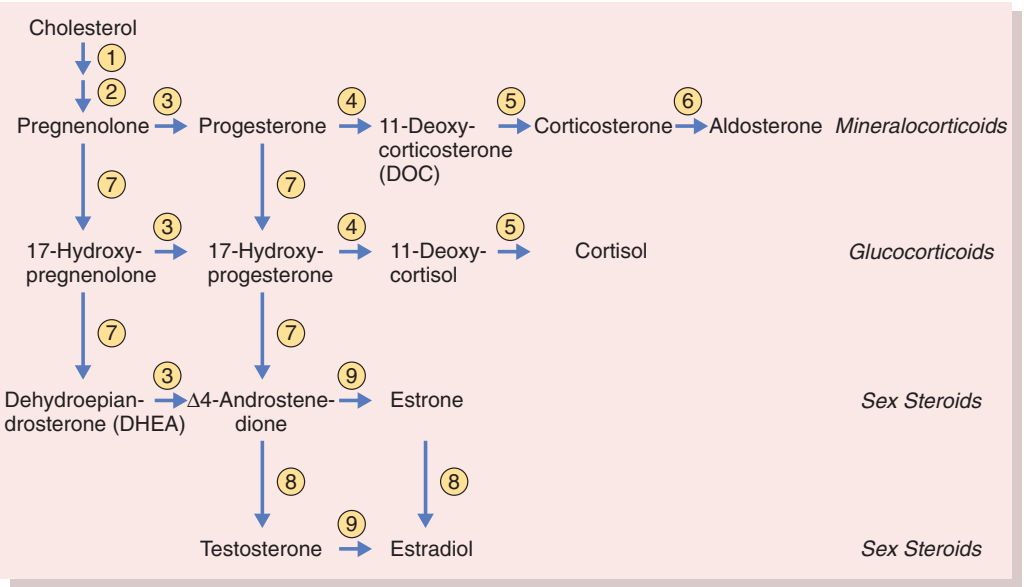

Enzyme Number	*Enzyme (Current and Trivial Name)*
1	StAR; Steroidogenic acute regulatory protein
2	CYP11A1; Cholesterol side-chain cleavage enzyme/desmolase
3	3β-HSD II; 3β-Hydroxylase dehydrogenase
4	CYP21A2; 21α-Hydroxylase
5	CYP11B1; 11β-Hydroxylase
6	CYP11B2; Corticosterone methyloxidase
7	CYP17; 17α-Hydroxylase/17, 20 lyase
8	17β-HSD; 17β-Hydroxysteroid dehydrogenase
9	CYP19; Aromatase

FIGURE 64-2 Pathways of steroid biosynthesis.

have minimal intrinsic androgenic activity, they contribute to androgenicity by their peripheral conversion to testosterone and dihydrotestosterone. In men, excessive levels of adrenal androgens have no clinical consequences, but in women they result in acne, hirsutism, and virilization. Because of gonadal production of androgens and estrogens and the secretion of norepinephrine by sympathetic ganglia, deficiencies of adrenal androgens and catecholamines are not clinically recognized.

SYNDROMES OF ADRENOCORTICAL HYPOFUNCTION

Adrenal Insufficiency

Glucocorticoid insufficiency can be primary, resulting from destruction or dysfunction of the adrenal cortex, or secondary, resulting from ACTH hyposecretion (Table 64-2). Autoimmune destruction of the adrenal glands (Addison's disease) is the most common cause of primary adrenal insufficiency in the industrialized world, accounting for about 65% of cases. Usually, both glucocorticoid and mineralocorticoid secretions are diminished in this condition which, if left untreated, can be fatal. Isolated glucocorticoid or mineralocorticoid deficiency may also occur, and it is becoming apparent that mild adrenal insufficiency (similar to subclinical hypothyroidism, discussed in Chapter 63) should also be diagnosed and, in some cases, treated. Adrenal medulla function is usually spared. About 70% of patients with Addison's disease have antiadrenal antibodies.

Tuberculosis used to be the most common cause of adrenal insufficiency. However, its incidence in the industrialized world has decreased since the 1960s, and it now accounts for only 15% to 20% of patients with adrenal insufficiency; calcified adrenal glands can be observed in 50% of these patients. Rare causes of adrenal insufficiency are listed in Table 64-2. Many patients with human immunodeficiency virus (HIV) infection have decreased adrenal reserve without overt adrenal insufficiency.

Addison's disease may be part of two distinct autoimmune polyglandular syndromes. The triad of hypoparathyroidism, adrenal insufficiency, and mucocutaneous candidiasis characterizes type I polyglandular autoimmune syndrome, which usually manifests in childhood. Other, less common manifestations include hypothyroidism, gonadal failure, gastrointestinal malabsorption, insulin-dependent diabetes mellitus, alopecia areata and totalis, pernicious anemia, vitiligo, chronic active hepatitis, keratopathy, hypoplasia of dental enamel and nails, hypophysitis, asplenism, and cholelithiasis. Type II polyglandular autoimmune syndrome, also called *Schmidt's syndrome*, is characterized by Addison's disease, autoimmune thyroid disease (Graves' disease or Hashimoto's thyroiditis), and insulin-dependent diabetes mellitus. Other associated diseases include pernicious anemia, vitiligo, gonadal failure, hypophysitis, celiac disease, myasthenia gravis, primary biliary cirrhosis, Sjögren's syndrome, lupus erythematosus, and Parkinson's disease. This syndrome usually develops in adults.

Common manifestations of adrenal insufficiency are anorexia, weight loss, increasing fatigue, occasional vomiting, diarrhea, and salt craving. Muscle and joint pain, abdominal pain, and postural dizziness may also occur. Signs of increased pigmentation