for synthesis of melanin and keratin leads to reduced skin pig-
mamentation. Hair is whitish and fragile (kinky hair). Babies with
Menkes disease are born underweight and demonstrate convul-
sions and other neurological symptoms shortly after birth. Psy-
chomotor retardation, muscular hypotonia, poor sucking, low
body temperature, abnormality in the blood vessels in the whole
body, and osteoporosis are present. Without proper treatment,
most patients die before age 3.

**Pathogenesis**

Mutation in the gene that codes for copper-transporting
ATPase (ATP7A) causes malabsorption of copper in the intestinal
tract, resulting in copper insufficiency in the body. This leads
to various symptoms. It is an X-linked recessive disorder; boys
are most commonly affected.

**Treatment**

Parenteral copper salt is effective in mild cases. The gene
responsible for Menkes disease has been identified; this may be
useful for gene therapies.

4. **Calcinosi cutis**

Calcinosi cutis is a condition in which calcium deposits in
large amounts to form firm, yellow to white papules or nodules.
When the deposition is in the stomach, kidneys, lungs muscles,
or in/under the skin and hypercalcemia is present, the cause is
parathyroid tumor, excessive intake of vitamin D, or bone
destruction caused by a tumor. Calcinosi cutis may appear as a
symptom in systemic sclerosis and dermatomyositis, even in
cases with normal serum calcium level (Fig. 17.17). There are
also idiopathic cases: e.g. scrotal calcinosi cutis (Fig. 17.18).

E. Vitamin deficiencies

1. **Pellagra**

**Outline**

- It is caused by lack of B vitamins, especially niacin.
- The main symptoms are dermatitis, diarrhea and demen-
tia.
- It most frequently occurs in recipients of isoniazid (INH),
  and in alcoholics and those who have had a gastrectomy
  or who have poor eating habits.
- Supplementation of niacin is the main treatment.

**Clinical features**

Symptoms of pellagra are characterized by the “3D’s”: 
dermatitis, diarrhea and dementia; however, there now tend to be few cases with all three symptoms together. The cutaneous symptoms are burning sensation and itchy photosensitive dermatosis. Sunburn-like eruptions appear on sun-exposed areas of the body, which develop into red-brown erythema, blistering and erosion. The skin coarsens. Sharply circumscribed, dark-brown pigmentation and atrophy are present (Fig. 17.19). Eruptions on the frontal neck region (the so-called V-neck zone) are called Casal’s necklace. Angular chelitis at the early stages and typhus-like intense diarrhea are characteristic gastrointestinal symptoms. Stomatitis, esophagitis, and nausea and vomiting occur. Psychoneurotic symptoms including depression, epileptic seizure, dementia, and peripheral neuropathy may occur.

**Pathogenesis**

Pellagra is caused by niacin deficiency. Although the mechanism of eruptions is unknown, it is associated with cellular deficiency of niacin that results from an inadequate dietary supply of niacin.

**Laboratory findings, Diagnosis**

The amount of N1-methyl nicotinamide, a metabolic product of niacin, quantitated in the urine for 24 hours is low. Pellagra should be carefully differentiated from other photosensitive dermatoses.

**Treatment, Prognosis**

Administration of nicotinic-acid amide, dietary improvement, and avoidance of exposure to light are useful.

### 2. Biotin deficiency

Biotin deficiency is caused by a lack of this water-soluble vitamin, which is associated with biosynthesis of fatty acids (Fig. 17.20). Cutaneous symptoms that resemble zinc deficiency syndrome occur, and alopecia and exfoliative dermatitis-like lesions are produced at sites that come into contact with diapers and in the intertriginous areas. Ichthyosis and erythroderma appear on the whole body in severe cases. Anemia accompanied by atrophy in the lingual papillae, loss of appetite, fatigue, and muscular pain are present.

### 3. Vitamin C deficiency

**Synonym: Scurvy**

Vitamin C (ascorbic acid) is essential for hydroxyproline production, which in turn is necessary for collagen synthesis. Deficiency leads to fragility of the blood vessels and the peripheral supporting structures, resulting in easy bleeding, follicular keratosis, purpura and bleeding in the gums. There may be systemic
symptoms, such as fatigue and bone fracture. However, these are promptly improved by vitamin C supplementation.

F. Porphyrias

Outline

- Porphyria is a general term for diseases caused by deposition of intermediate products such as porphyrins in the liver or skin, as a result of congenital or acquired impairment of an enzyme essential for heme synthesis.
- It is divided into hepatogenous porphyrias and myelogenous ones.
- The main cutaneous symptom is photosensitivity accompanied by blistering.

Classification, Pathogenesis

Porphyrin is a general term for molecules that have a porphyrin ring, which is an intermediate metabolite synthesized in the process of heme biosynthesis from glycine and succinyl-CoA. This biosynthesis occurs in various cells, particularly in the liver and bone marrow. Metabolic enzymes such as P450 occur as

Fig. 17.21 Metabolic pathway of porphyrin and functional enzymes (arrows).