- Exposure to *formaldehyde*, used in the manufacture of building materials (e.g., cabinetry, furniture, adhesives) may be a health problem in refugees from environmental disasters living in poorly ventilated trailers. At concentrations of 0.1 ppm or higher, it causes breathing difficulties and a burning sensation in the eyes and throat, and can trigger asthma attacks. Formaldehyde is classified as a carcinogen for humans and animals.
- The so-called *sick building syndrome* remains an elusive problem; it may be a consequence of exposure to one or more indoor pollutants, possibly due to poor ventilation.

KEY CONCEPTS

Environmental Diseases and Environmental Pollution

- Environmental diseases are conditions caused by exposure to chemical or physical agents in the ambient, workplace, and personal environments.
- Exogenous chemicals known as *xenobiotics* enter the body through inhalation, ingestion, and skin contact, and can either be eliminated or accumulate in fat, bone, brain, and other tissues.
- Xenobiotics can be converted into nontoxic products, or activated to generate toxic compounds, through a two-phase reaction process that involves the cytochrome P-450 system.
- The most common and important air pollutants are ozone (which in combination with oxides and particulate matter forms smog), sulfur dioxide, acid aerosols, and particles less than 10 μm in diameter.
- Carbon monoxide poisoning an important cause of death from accidents and suicide; it binds hemoglobin with high affinity, leading to systemic asphyxiation associated with CNS depression.
- A variety of pollutants, including smokes, bioaerosols, radon, and formaldehyde, may accumulate in indoor air and cause disease.

Metals as Environmental Pollutants

Lead, mercury, arsenic, and cadmium are the heavy metals most commonly associated with harmful effects in humans.

Lead

Lead is a readily absorbed metal that binds to sulfhydryl groups in proteins and interferes with calcium metabolism, effects that lead to hematologic, skeletal, neurologic, gastrointestinal, and renal toxicities. Lead exposure may occur through contaminated air, food and water. For most of the twentieth century the major sources of lead in the environment were lead-containing house paints and gasoline. Although limits have been set for the amounts of lead contained in residential paints and use of leaded gasoline in road vehicles was banned in the United States in 1996, lead contamination remains an important health hazard, particularly for children. The large-scale recall of toys containing lead in 2007 alerted the general public to the dangers of lead exposures. There are many sources of lead in the environment, such as from mining, foundries, batteries, and spray painting, which constitute occupational hazards. However, *flaking lead paint* in older houses and soil contamination pose major hazards to youngsters. During the past 30 years, the median blood level of lead in preschool children in the United States decreased from 15 μg/dL to the present level of less than 2 μg/dL due to public health measures. Nevertheless, blood levels of lead in children living in older homes containing lead-based paint or lead-contaminated dust often exceed 5 μg/dL, the level at which the Centers for Disease Control and Prevention (CDC) recommends that measures be taken to limit further exposure. While treatment for lead poisoning in children is currently mandated only when blood lead levels are ≥45 μg/dL, it is believed that *subclinical lead poisoning* may occur in children with blood lead levels considerably below this mark. The results of low-level lead poisoning include subtle deficits in intellectual capacity, behavioral problems such as hyperactivity, and poor organizational skills. Lead poisoning, although less common in adults, occurs mainly as an occupational hazard in those involved in the manufacturing of batteries, pigments, car radiators, and tin cans. The main clinical features of lead poisoning in children and adults are shown in Figures 9-5 and 9-6.

Most of the absorbed lead (80% to 85%) is incorporated into bone and developing teeth, where it competes with calcium; its half-life in bone is 20 to 30 years. High levels of lead cause *CNS disturbances* in adults and children, but *peripheral neuropathies* predominate in adults. Children absorb more than 50% of ingested lead (compared with

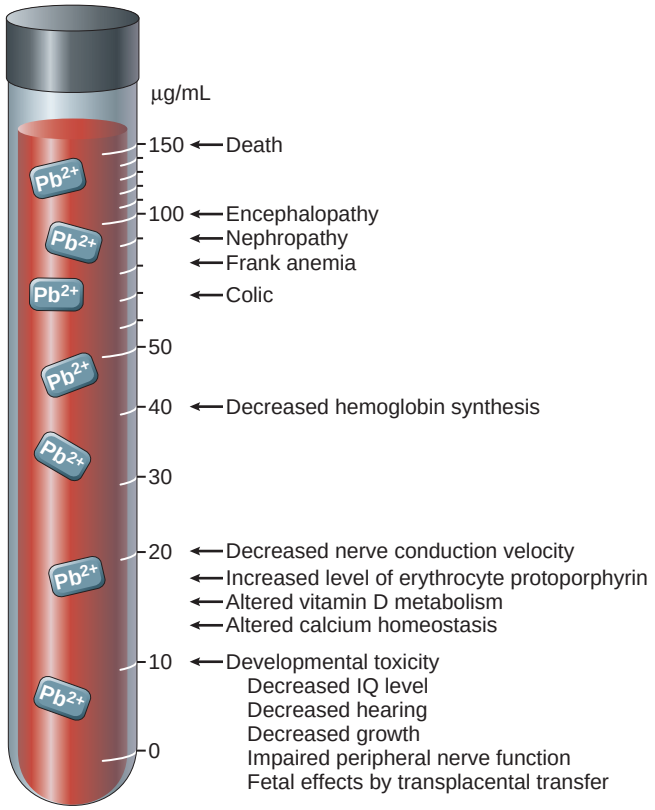

Figure 9-5 Effects of lead poisoning in children related to blood levels. (Modified from Bellinger DC, Bellinger AM: Childhood lead poisoning: the tortuous path from science to policy. J Clin Invest 116:853; 2006.)