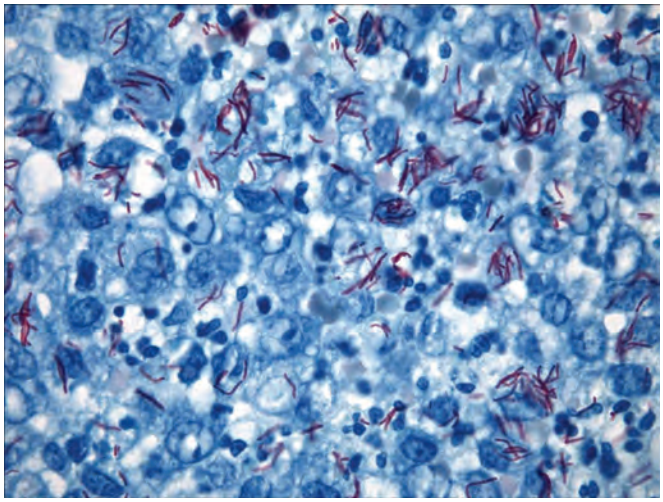

Figure 8-30 *Mycobacterium avium* infection in a patient with AIDS, showing massive infection with acid-fast organisms. This pattern is more common in patients with acquired immunodeficiencies.

causes widely disseminated infections, and organisms proliferate abundantly in many organs, including the lungs and gastrointestinal system. Patients are feverish, with drenching night sweats and weight loss. In the rare case of MAC in a person without HIV, the organisms primarily infect the lung, causing a productive cough and sometimes fever and weight loss.

MORPHOLOGY

The hallmark of MAC infections in patients with HIV is abundant acid-fast bacilli within macrophages (Fig. 8-30). Depending on the severity of immune deficiency, MAC infections can be widely disseminated throughout the mononuclear phagocyte system, causing enlargement of involved lymph nodes, liver, and spleen, or localized to the lungs. There may be a yellowish pigmentation to these organs secondary to the large number of organisms present in swollen macrophages. Granulomas, lymphocytes, and tissue destruction are rare.

Leprosy

Leprosy, or *Hansen disease,* is a slowly progressive infection caused by *M. leprae* that mainly affects the skin and peripheral nerves. Despite its low communicability, leprosy remains endemic among people living in several developing tropical nations.

Pathogenesis. The source of infection and route of transmission are not known, however human respiratory secretions or soil are likely origins. *M. leprae* is taken up by macrophages and disseminates in the blood, but it replicates primarily in relatively cool tissues of the skin and extremities. It proliferates best at 32° to 34°C, the temperature of the human skin. Like *M. tuberculosis, M. leprae* secretes no toxins, and its virulence is based on properties of its cell wall, which is similar enough to that of *M. tuberculosis* that immunization with BCG confers some protection against *M. leprae* infection. Cell-mediated immunity is manifested by delayed-type hypersensitivity reactions to dermal injections of a bacterial extract called *lepromin.*

***M. leprae* causes two strikingly different patterns of disease, called tuberculoid and lepromatous. The helper T-lymphocyte response to *M. leprae* determines whether an individual has tuberculoid or lepromatous leprosy.** People with the less severe *tuberculoid leprosy* have dry, scaly skin lesions that lack sensation. They often have asymmetric involvement of large peripheral nerves. The more severe form, *lepromatous leprosy*, includes symmetric skin thickening and nodules. In lepromatous leprosy, widespread invasion of the mycobacteria into Schwann cells and into endoneural and perineural macrophages damages the peripheral nervous system. In advanced cases of lepromatous leprosy, *M. leprae* is present in sputum and blood. People can also have intermediate forms of disease, called *borderline leprosy.*

As mentioned earlier, tuberculoid and lepromatous leprosy are associated with different T cell responses. People with tuberculoid leprosy have a T_H1 response associated with production of IL-2 and IFN-γ. As with *M. tuberculosis*, IFN-γ functions to mobilize an effective host macrophage response and hence the microbial burden is low. Lepromatous leprosy is associated with a weak T_H1 response and, in some cases, a relative increase in the T_H2 response. The net result is weak cell-mediated immunity and an inability to control the bacteria, which can be readily visualized in tissue sections. Occasionally, most often in the lepromatous form, antibodies are produced against *M. leprae* antigens. Paradoxically, these antibodies are usually not protective, but they may form immune complexes with free antigens that can lead to erythema nodosum, vasculitis, and glomerulonephritis.

MORPHOLOGY

Tuberculoid leprosy begins with localized flat, red skin lesions that enlarge and develop irregular shapes with indurated, elevated, hyperpigmented margins and depressed pale centers (central healing). Neuronal involvement dominates tuberculoid leprosy. Nerves become enclosed within granulomatous inflammatory reactions and, if small (e.g., the peripheral twigs), are destroyed (Fig. 8-31). Nerve degeneration causes skin anesthesias and skin and muscle atrophy that render the person liable to trauma of the affected parts, leading to the development of chronic skin ulcers. Contractures, paralyses, and autoamputation of fingers or toes may ensue. Facial nerve involvement can lead to paralysis of the eyelids, with keratitis and corneal ulcerations. On microscopic examination, all sites of involvement have granulomatous lesions closely resembling those found in tuberculosis. Because of the strong host defense, bacilli are almost never found, hence the name **paucibacillary** leprosy. The presence of granulomas and absence of bacteria reflect strong T-cell immunity. Because leprosy pursues an extremely slow course, spanning decades, most patients die with leprosy rather than of it.

Lepromatous leprosy involves the skin, peripheral nerves, anterior eye chamber, upper airways (down to the larynx), testes, hands, and feet. The vital organs and CNS are rarely affected, presumably because the core temperature is too high for growth of *M. leprae*. Lepromatous lesions contain large aggregates of lipid-laden macrophages (lepra cells), often filled with masses ("globi") of acid-fast bacilli (Fig. 8-32). Because of the abundant bacteria, lepromatous leprosy is referred to as