Well-demarcated necrotic and hemorrhagic oval skin lesions, called **ecthyma gangrenosum**, often appear. Disseminated intravascular coagulation is a frequent complication of *P. aeruginosa* bacteremia.

Plague

***Yersinia pestis* is a gram-negative facultative intracellular bacterium that causes an invasive, frequently fatal, infection called *plague*.** It is transmitted from rodents to humans by fleabites or, less often, from one human to another by aerosols. Plague, also named *Black Death,* caused three great pandemics that killed an estimated 100 million people in Egypt and Byzantium in the sixth century; one quarter of Europe's population in the fourteenth and fifteenth centuries; and tens of millions in India, Myanmar, and China at the beginning of the twentieth century. Most cases now occur in Africa, but the organism is endemic in many parts of the world, including nations in the former Soviet Union, the Americas, and Asia. Wild rodents in the rural western United States are infected with *Y. pestis*, and are the source of 10 to 15 human cases every year. *Y. enterocolitica* and *Y. pseudotuberculosis* are genetically similar to *Y. pestis*; these bacteria cause fecal-orally transmitted ileitis and mesenteric lymphadenitis.

Y. pestis ensures its own spread by forming a biofilm that obstructs the gut of the infected flea. The starving flea bites and regurgitates before it feeds, and thus infects the rodent or human that it is biting. The bacteria spread from the site of inoculation to lymphoid tissues, where they proliferate and inhibit the host from mounting an effective response. *Y. pestis* has a plasmid-borne complex of genes, the Yop virulon, which encodes a type III secretion system, a hollow syringe-like structure that projects from the bacterial surface, binds to host cells, and injects bacterial proteins, called *Yops* (*Yersinia* outercoat proteins), into the cell. YopE, YopH, and YopT block phagocytosis by inactivating molecules that regulate actin polymerization. YopJ inhibits the signaling pathways that are activated by LPS, blocking the production of inflammatory cytokines.

MORPHOLOGY

Yersinia pestis causes lymph node enlargement (buboes), pneumonia, or sepsis with a striking neutrophilia. The distinctive histologic features include (1) massive proliferation of the organisms, (2) early appearance of protein-rich and polysaccharide-rich effusions with few inflammatory cells, (3) necrosis of tissues and blood vessels with hemorrhage, thrombosis, and marked tissue swelling, and (4) neutrophilic infiltrates that accumulate adjacent to necrotic areas as healing begins.

In **bubonic plague** the infected fleabite is usually on the legs, where it forms a small pustule or ulcer. The draining lymph nodes enlarge dramatically within a few days and become soft, pulpy, and plum colored, and may infarct or rupture through the skin. In **pneumonic plague** there is a severe, confluent, hemorrhagic and necrotizing bronchopneumonia, often with fibrinous pleuritis. In **septicemic plague** lymph nodes throughout the body as well as organs rich in mononuclear phagocytes develop foci of necrosis. Fulminant bacteremia also induces disseminated intravascular coagulation with widespread hemorrhages and thrombi.

Chancroid (Soft Chancre)

Chancroid is an acute, sexually transmitted, ulcerative infection caused by *Haemophilus ducreyi*. The disease is most common in tropical and subtropical areas among lower socioeconomic groups and men who have frequent sex with prostitutes. Chancroid is one of the most common causes of genital ulcers in Africa and Southeast Asia, where it probably serves as an important cofactor in the transmission of HIV infection. Chancroid is uncommon in the United States, with 20 to 50 cases per year reported to the Centers for Disease Control and Prevention (CDC) in the past several years. The organism is difficult to grow in culture and PCR-based tests are not widely available, so chancroid is likely to be underdiagnosed.

MORPHOLOGY

Four to 7 days after inoculation, a tender erythematous papule involving the external genitalia develops. In males, the primary lesion is usually on the penis; in females, most lesions occur in the vagina or the periurethral area. Over several days, the surface of the primary lesion erodes to produce an irregular, painful ulcer. In contrast to the primary chancre of syphilis, the ulcer of chancroid is not indurated, and multiple lesions may be present. The base of the ulcer is covered by shaggy, yellow-gray exudate. The regional lymph nodes become enlarged and tender in about 50% of cases within 1 to 2 weeks after primary infection. If the infection is not treated, the enlarged nodes (buboes) may erode the overlying skin to produce chronic, draining ulcers.

Microscopically, the ulcer of chancroid contains a superficial zone of neutrophilic debris and fibrin, and an underlying zone of granulation tissue containing areas of necrosis and thrombosed vessels. A dense, lymphoplasmacytic inflammatory infiltrate is present beneath the layer of granulation tissue. Coccobacilli are sometimes demonstrable in Gram or silver stains, but they are often obscured by other bacteria that colonize the ulcer base.

Granuloma Inguinale

Granuloma inguinale, or donovanosis, is a sexually transmitted chronic inflammatory disease caused by *Klebsiella granulomatis* (formerly called *Calymmatobacterium donovani*), a minute, encapsulated, coccobacillus. Granuloma inguinale is uncommon in the United States and Western Europe but is endemic in rural areas in some developing countries. Untreated cases are characterized by the development of extensive scarring, often associated with lymphatic obstruction and lymphedema (elephantiasis) of the external genitalia. Culture of the organism is difficult, and PCR assays are not widely available, so the diagnosis is made by microscopic examination of smears or biopsy samples of the ulcer.

MORPHOLOGY

Granuloma inguinale begins as a raised papular lesion on the moist stratified squamous epithelium of the genitalia or, rarely, the oral mucosa or pharynx. The lesion eventually ulcerates and develops abundant granulation tissue, which manifests grossly