

bacteria are a continuing problem due to widespread use of antibiotics (e.g., MRSA and vancomycin-resistant *Enterococcus*). Human commercial use of dense populations of domestic animals (e.g., pigs, chickens) juxtaposed to habitat destruction of other disease reservoirs (e.g., bats and wild birds) can lead to acquisition of either unique traits in common pathogens such as influenza or emergence of unique viruses such as severe acute respiratory syndrome (SARS) virus and West Nile Virus. Because these pathogens are novel, humans lack immunity and so these infections can quickly spread through the population as pandemics, as was seen with influenza A H1N1 in 2009.

**Agents of Bioterrorism.** Sadly, the anthrax attacks in the United States in 2001 transformed the theoretical threat of bioterrorism into reality. The CDC has evaluated the microorganisms that pose the greatest danger as weapons on the basis of the efficiency with which disease can be transmitted, how difficult the microorganisms are to produce and distribute, what can be done to defend against them, and the extent to which they are likely to alarm the public and produce widespread fear.

- Category A agents pose the highest risk and can be readily disseminated or transmitted from person to person, can cause high mortality with potential for major public health impact, might cause public panic and social disruption, and might require special action for public health preparedness. For example, smallpox is a category A agent because of its high transmissibility in any climate or season, case mortality rate of 30% or greater, and lack of effective antiviral therapy. This agent can be easily disseminated because of the stability of the virus in aerosol form and the very small dose needed for infection. Smallpox naturally spreads from person to person mainly by direct contact with virus in skin lesions or contaminated clothing or bedding. Symptoms appear after 7 to 17 days. Initially there is high fever, headache, and backache, followed by the appearance of the rash, which first appears on the mucosa of the mouth and pharynx, face, and forearms and later spreads to the trunk and legs and becomes vesicular and later pustular. Because people can be contagious during the incubation period, this virus has the potential to continue to spread throughout an unprotected population. Since vaccination ended in the United States in 1972 and vaccination immunity has waned, the population is highly susceptible to smallpox. Recent concern that smallpox could be used for bioterrorism has led to a return of vaccination for selected groups in the United States and Israel.
- Category B agents are relatively easy to disseminate, produce moderate morbidity but low mortality, and require specific diagnostic and disease surveillance. Many of these agents are foodborne or waterborne. Examples include *Brucella* sp., *Vibrio cholerae*, and ricin toxin from castor beans.
- Category C agents include emerging pathogens that could be engineered for mass dissemination because of availability, ease of production and dissemination, potential for high morbidity and mortality, and great impact on health. Examples include Hantavirus and Nipahvirus.

## SUGGESTED READINGS

### General Principles of Microbial Pathogenesis

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