

Figure 2.1 Phylogenetic tree for microorganisms representing three major divisions (phyla): Bacteria, Archaea, and Eukarya. (Redrawn based on Eckburg, P.B. et al., *Infect. Immun.*, 71, 591–596, 2003.) Representative classes of microorganisms are listed for each division (phylum).

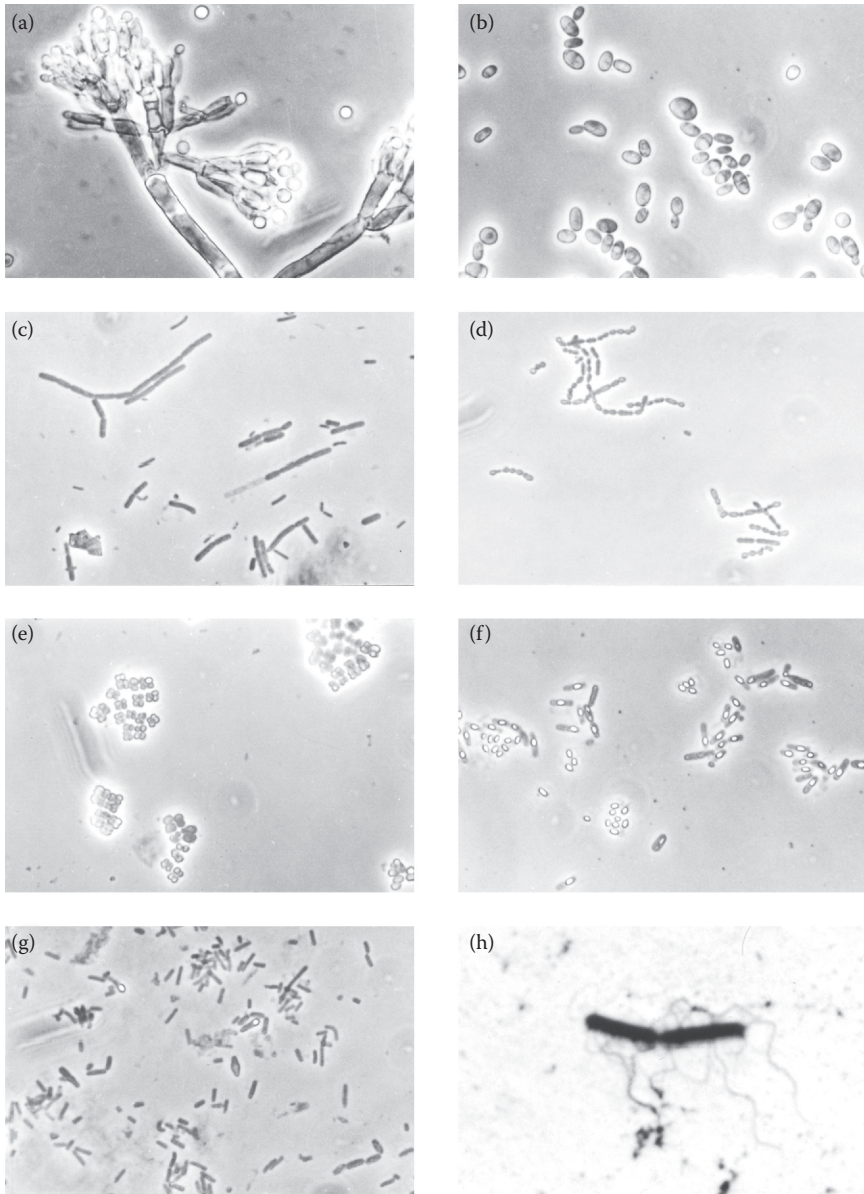


Figure 2.2 Photograph of microbial morphology. (a) Molds: conidial head of *Penicillium* sp. showing conidiophore (stalk) and conidia. (b) Yeasts: *Saccharomyces cerevisiae*, some carrying buds. (c) Rod-shaped bacteria: *Bacillus* sp., single and chain. (d) Spherical-shaped bacteria: *Streptococcus* sp., chain. (e) Spherical-shaped bacteria: tetrads. (f) *Bacillus* cells carrying spores, center and off-center. (g) *Clostridium* cells, some carrying terminal spores (drumstick appearance). (h) Motile rod-shaped bacterium (*Clostridium* sp.) showing peritrichous flagella.

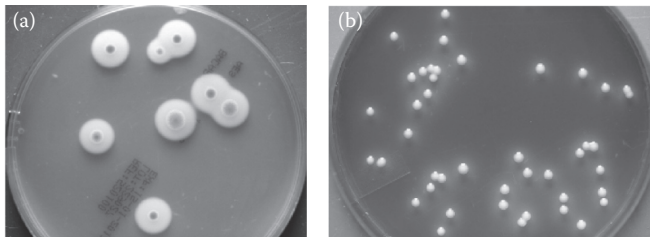


Figure 2.3 (See color insert.) Colony formation by Gram-positive (a) *Bacillus thuringiensis* on BACARA chromogenic media from bioMérieux and Gram-negative (b) *Klebsiella pneumoniae* on XLT-4 (Xylose-Lysine-Tergitol-4) agar media representing different colony appearances.

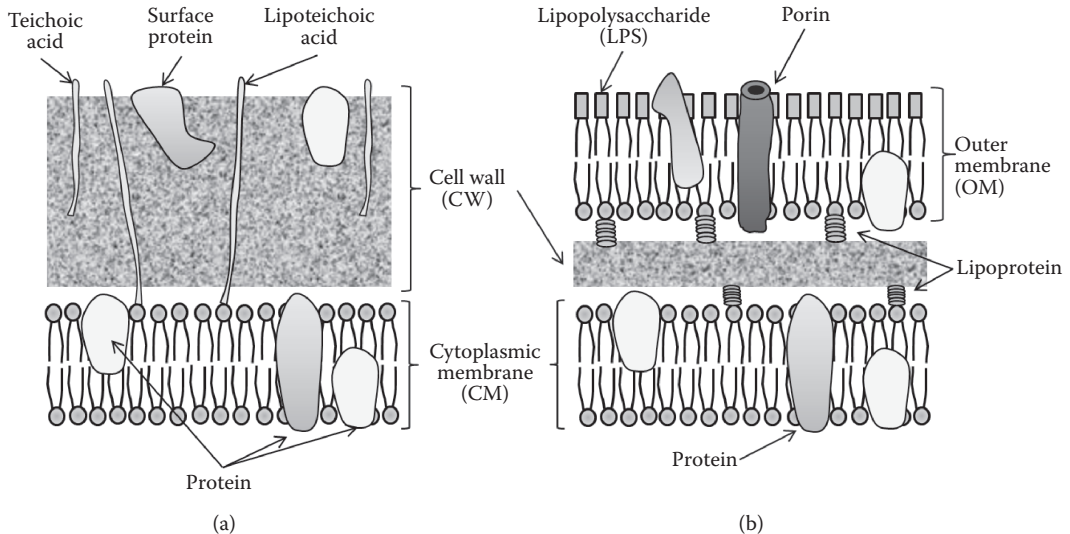


Figure 2.4 Schematic representations of cell structure of bacteria. (a) Gram-positive bacteria: CW: cell wall showing thick mucopeptide backbone layers covalently linked to peptides, teichoic acids (or teichouronic acid); lipoteichoic acids (anchored to cytoplasmic membrane); CM: cytoplasmic membrane with lipid bilayers containing phospholipids, glycolipids, and embedded proteins. (b) Gram-negative bacteria: OM: outer membrane containing lipopolysaccharide (LPS) molecules, stabilized by divalent cations, phospholipids, and proteins; CW: middle membrane containing thin mucopeptide layers covalently linked to peptides and lipoproteins; CM: cytoplasmic membrane with phospholipid bilayers and proteins.