

- 1  **A Brief Journey to the Microbial World**  
Chapter 2
- 2  **2.1 Some Principles of Light Microscopy**
  - *Light microscopes:*
    - relatively low magnification
  - *Resolution:*
    - ability to distinguish two adjacent objects
    - determined by the wavelength of light
      - Limit for light microscope  $\sim 0.2 \mu\text{m}$
- 3  **2.1 Some Principles of Light Microscopy**
  - Compound light microscope
    - visible light
  - Many different types of light microscopy:
    - Bright-field
    - Phase-contrast
    - Dark-field
    - Fluorescence
- 4  **Cells of Baker's Yeast With Different Types of Microscopy**
- 5
- 6  **2.4 Electron Microscopy**
  - Electron microscopes
    - electrons instead of photons
  - Two types
    - *Transmission Electron Microscopes (TEM)*
    - *Scanning Electron Microscopes (SEM)*
- 7  **2.4 Electron Microscopy**
  - *Transmission Electron Microscopy (TEM)*
    - Electromagnets function as lenses
    - System operates in a vacuum
    - High magnification and resolution (0.2 nm)
    - Enables visualization of structures at the molecular level
    - Specimen must be very thin (20 – 60 nm) and be stained
- 8  **2.4 Electron Microscopy**
  - *Scanning Electron Microscopy (SEM)*
    - Specimen is coated with a thin film of heavy metal (e.g., gold)
    - An electron beam scans the object
    - Scattered electrons are collected by a detector and an image is produced
    - Even very large specimens can be observed
    - Magnification range of 15X – 100,000X
- 9
- 10  **2.2 Improving and Adjusting Contrast in Light Microscopy**
  - Improving contrast = better image
  - Staining improves contrast
    - Dyes
      - organic compounds with different affinities for specific cellular materials
        - methylene blue, safranin, & crystal violet
- 11  **2.2 Improving and Adjusting Contrast in Light Microscopy**
  - Differential Stains: *The Gram stain*
  - Divides bacteria into two major groups:
    - gram-positive (purple)

- gram-negative (red)
- 12  **2.5 Elements of Cell and Viral Structure**
  - All microbial cells have the following in common:
    - Cytoplasmic membrane
    - Cytoplasm
    - Ribosomes
- 13  **2.5 Elements of Cell and Viral Structure**
  - Eukaryotes
    - DNA in membrane-bound nucleus
    - Cells larger & more complex
    - Contain organelles
  - Prokaryotes
    - No membrane-enclosed organelles
    - No nucleus
    - smaller than eukaryotic cells
- 14  **2.5 Elements of Cell and Viral Structure**
  - Viruses
    - Not considered cells
    - No metabolic abilities
    - Rely completely machinery of infected cell
    - Infect all types of cells
- 15  **2.6 Arrangement of DNA in Microbial Cells**
  - Genome
    - A cell's full complement of genes
  - Prokaryotic
    - single, circular molecule (*chromosome*)
    - DNA aggregates to form nucleoid region
    - Prokaryotes
      - extra-chromosomal DNA (plasmids)
        - confer special properties (antibiotic resistance)
- 16  **2.6 Arrangement of DNA in Microbial Cells**
  - Eukaryotic DNA is linear & found in the nucleus
    - proteins help in folding the DNA
    - Usually more than one chromosome
    - Typically two copies of each chromosome
- 17  **2.6 Arrangement of DNA in Microbial Cells**
  - *Escherichia coli* Genome
    - 4.68 million base pairs
    - 4,300 genes
    - 1,900 different kinds of protein
    - 2.4 million protein molecules
  - Human Cell
    - 1,000X more DNA per cell than *E. coli*
    - 7X more genes than *E. coli*