

The archaeabacteria usually live in extreme environments and possess unusual metabolism. Methanogens, which are methane-producing bacteria, belong to this group, as well as the thermoacidophiles. The thermoacidophiles can grow at high temperatures and low pH values. The halobacteria, which can live only in very strong salt solutions, are members of this group. These organisms are important sources for catalytically active proteins (enzymes) with novel properties.

2.1.5. Eucaryotes

Fungi (yeasts and molds), algae, protozoa, and animal and plant cells constitute the eucaryotes. Eucaryotes are five to ten times larger than prokaryotes in diameter (e.g., yeast about 5 μm , animal cells about 10 μm , and plants about 20 μm). Eucaryotes have a true nucleus and a number of cellular organelles inside the cytoplasma. Figure 2.3 is a schematic of two typical eucaryotic cells.

In cell wall and cell membrane structure, eucaryotes are similar to prokaryotes. The plasma membrane is made of proteins and phospholipids that form a bilayer structure. Major proteins of the membrane are hydrophobic and are embedded in the phospholipid matrix. One major difference is the presence of sterols in the cytoplasmic membrane of eucaryotes. Sterols strengthen the structure and make the membrane less flexible. The cell wall of eucaryotic cells shows considerable variations. Some eucaryotes have a peptidoglycan layer in their cell wall; some have polysaccharides and cellulose (e.g., algae). The plant cell wall is composed of cellulose fibers embedded in pectin aggregates, which impart strength to the cell wall. Animal cells do not have a cell wall but only a cytoplasmic membrane. For this reason, animal cells are very shear-sensitive and fragile. This factor significantly complicates the design of large-scale bioreactors for animal cells.

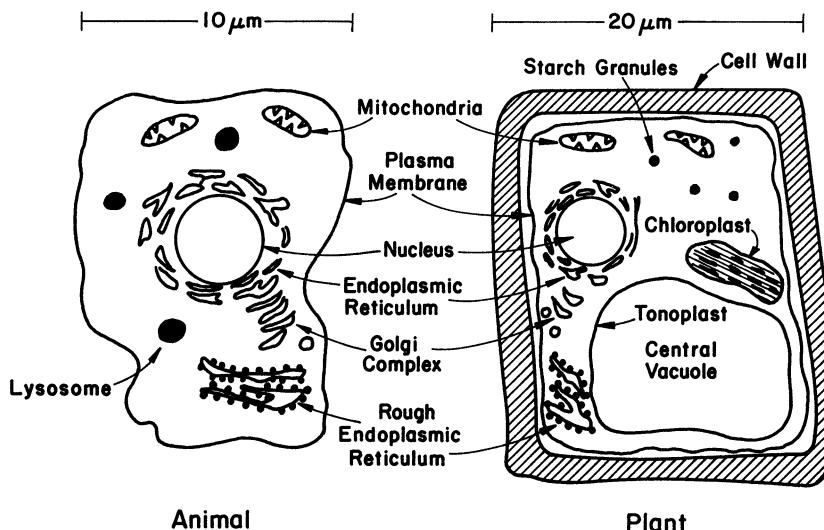


Figure 2.3. Sketches of the two primary types of higher eucaryotic cells. Neither sketch is complete, but each summarizes the principal differences and similarities of such cells.