

addition of letters and numbers. For example, *E. coli* B/r A will differ in growth and physiological properties from *E. coli* K12.

Now that we know how to name organisms, we could consider broader classification up to the level of kingdoms. There is no universal agreement on how to classify microorganisms at this level. Such classification is rather arbitrary and need not concern us. However, we must be aware that there are two primary cell types: *eucaryotic* and *procaryotic*. The primary difference between them is the presence or absence of a membrane around the cell's genetic information.

Procaryotes have a simple structure with a single chromosome. Procaryotic cells have no nuclear membrane and no organelles, such as the mitochondria and endoplasmic reticulum. Eucaryotes have a more complex internal structure, with more than one chromosome (DNA molecule) in the nucleus. Eucaryotic cells have a true nuclear membrane and contain mitochondria, endoplasmic reticulum, golgi apparatus, and a variety of specialized organelles. We will soon describe each of these components (Section 2.1.5). A detailed comparison of procaryotes and eucaryotes is presented in Table 2.1. Structural differences between procaryotes and eucaryotes are discussed later.

Recently, it has become obvious that the situation is even more complicated. Evidence suggests that a common or universal ancestor gave rise to three distinctive branches of life: eucaryotes, eubacteria (or “true” bacteria), and archaeabacteria. Table 2.2 summarizes some of the distinctive features of these groups. The ability to sequence the genes of whole organisms will have a great impact on our understanding of how these families evolved and are related.

Viruses cannot be classified under any of these categories, as they are not free-living organisms. Let's consider first some of the characteristics of these rather simple “organisms.”

TABLE 2.1 A Comparison of Procaryotes with Eucaryotes

Characteristic	Procaryotes	Eucaryotes
Genome		
No. of DNA molecules	One	More than one
DNA in organelles	No	Yes
DNA observed as chromosomes	No	Yes
Nuclear membrane	No	Yes
Mitotic and meiotic division of the nucleus	No	Yes
Formation of partial diploid	Yes	No
Organelles		
Mitochondria	No	Yes
Endoplasmic reticulum	No	Yes
Golgi apparatus	No	Yes
Photosynthetic apparatus	Chlorosomes	Chloroplasts
Flagella	Single protein, simple structure	Complex structure, with microtubules
Spores	Endospores	Endo- and exospores
Heat resistance	High	Low

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