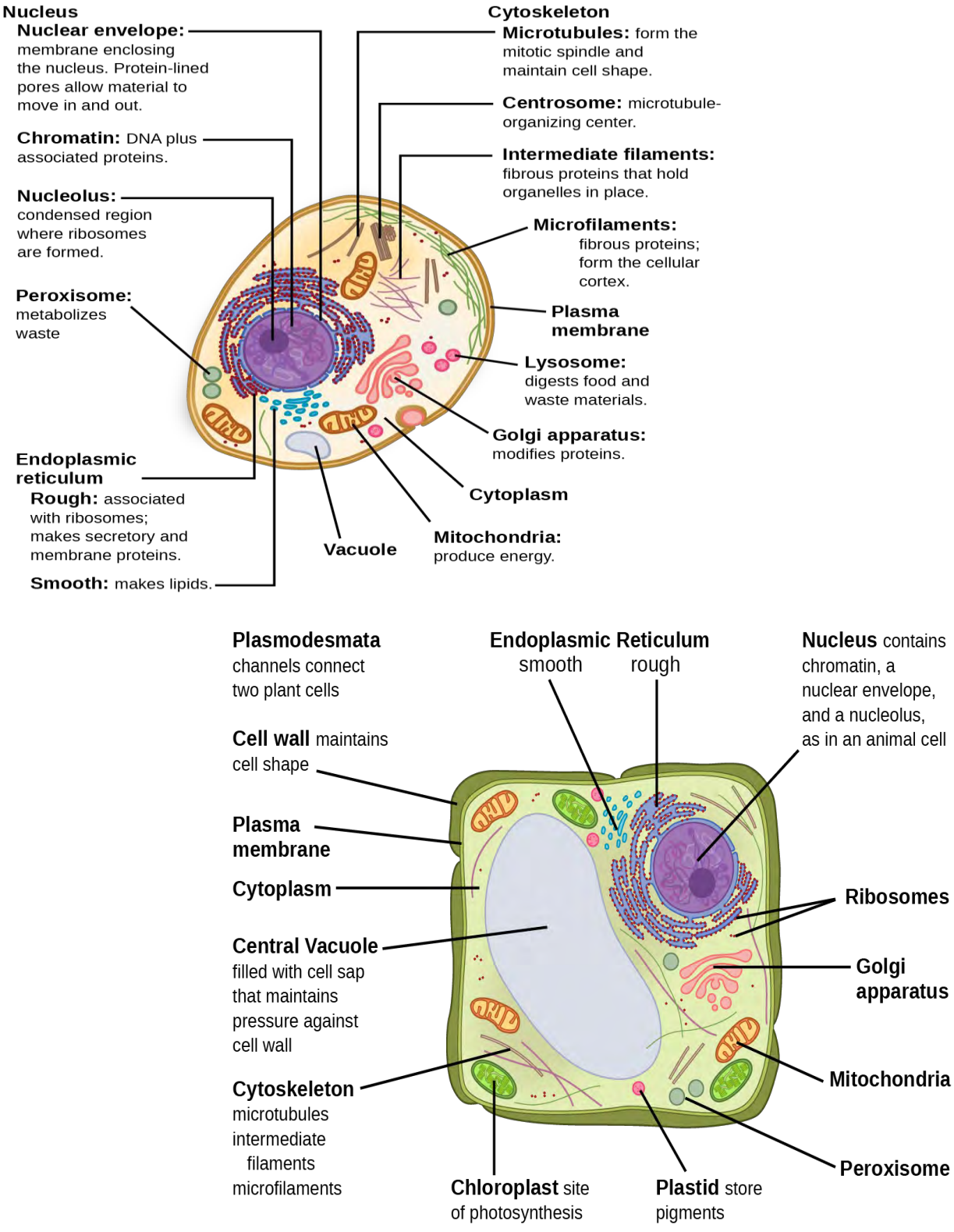

Figure 4.18 These figures show the major organelles and other cell components of (a) a typical animal cell and (b) a typical plant cell. (credit: Clark et al. / Biology 2E OpenStax)

The Endomembrane System

The **endomembrane system** (endo = "within") is a group of membranes and organelles (Figure 4.19) in eukaryotic cells that works together to modify, package, and transport lipids and proteins. It includes the nuclear envelope, lysosomes, vesicles, the endoplasmic reticulum, and the Golgi apparatus. Although not technically *within* the cell, the plasma membrane is included in the endomembrane system because it interacts with the other endomembranous organelles. The endomembrane system does not include organelles such as the mitochondria or chloroplast, which are used for energy processing.

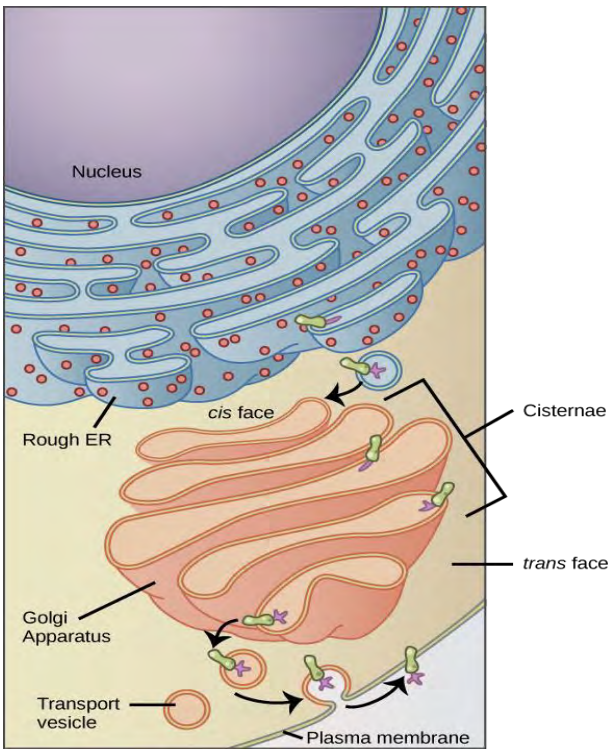

Figure 4.19 Various organelles that are part of the endomembrane system. (credit: modification of work by Magnus Manske / Biology 2E OpenStax)

The Nucleus

Typically, the nucleus is the most prominent organelle in a cell (Figure 4.18). The **nucleus** (plural = nuclei) houses the cell's DNA in the form of chromatin and directs the synthesis of ribosomes and proteins.

The **nuclear envelope** is a double-membrane structure that constitutes the outermost portion of the nucleus. Both the inner and outer membranes of the nuclear envelope are phospholipid bilayers. The nuclear envelope is punctuated with **nuclear pores** that control the passage of ions, molecules, and RNA between the nucleus and the cytoplasm (Figure 4.20).

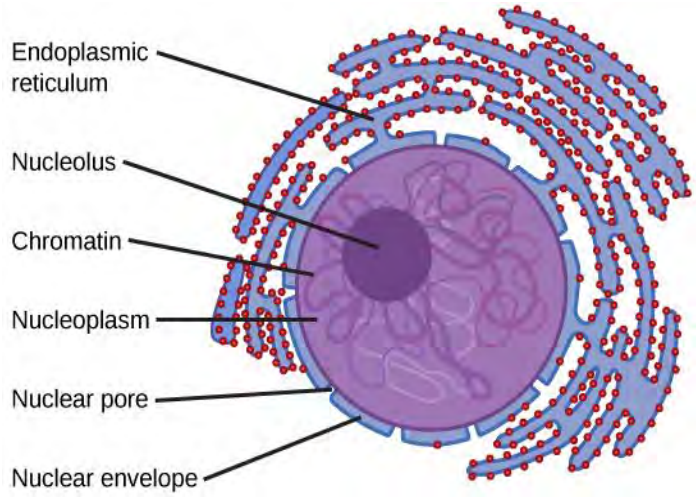

Figure 4.20 The outermost boundary of the nucleus is the nuclear envelope. (credit: modification of work by NIGMS, NIH / Concepts of Biology OpenStax)

Chromosomes, found in the nucleus, contain the cell's genetic information. They are composed of DNA wound around proteins (Figure 4.21). Together, this combination of DNA and proteins is called **chromatin** (Figure 4.21). When cells are not dividing, individual chromosomes are not visible, and the material in the nucleus is referred to as chromatin.

In eukaryotes, chromosomes are linear structures. Every species has a specific number of chromosomes in its nucleus. For example, humans should have 46 chromosomes in all their body cells except their eggs and sperm. Fruit flies, on the other hand, have a total of eight chromosomes in each of their cells.

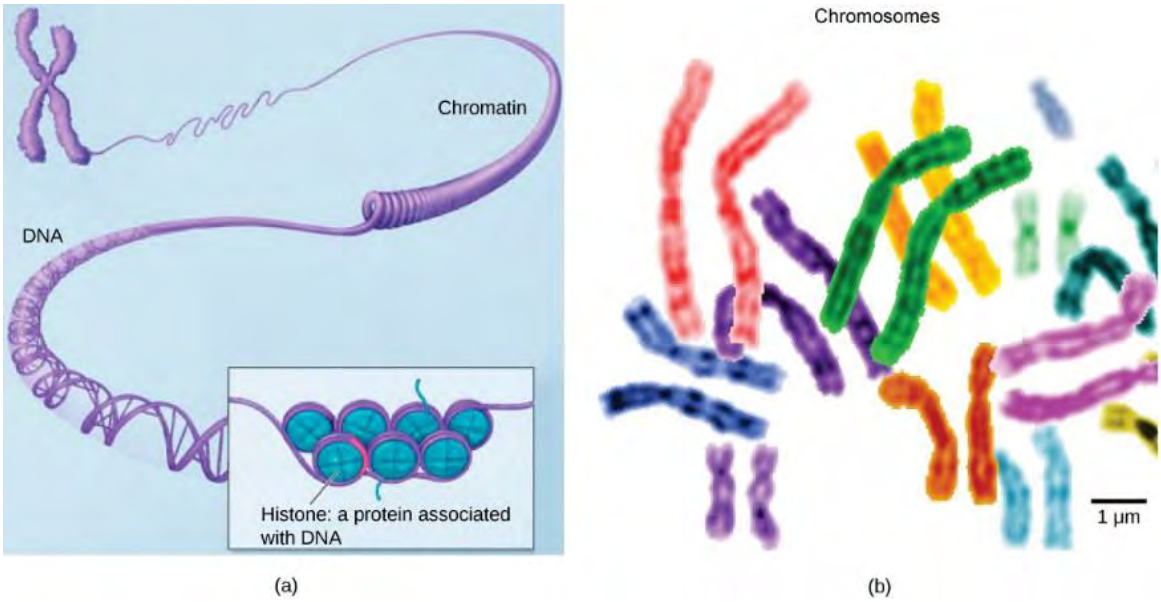

Figure 4.21 (a) This image shows various levels of chromatin's organization. (b) This image shows the paired chromosomes. (credit b: modification of work by NIH; scale-bar data from Matt Russell / Biology 2E OpenStax)

Chromosomes are only visible and distinguishable from one another when the cell is getting ready to divide. When a cell is in the growth and maintenance phases of its life cycle, the chromosomes resemble an unwound, jumbled bunch of threads.

The DNA in the nucleus directs the synthesis of ribosomes, but how does it do this? Some chromosomes have sections of DNA that encode ribosomal RNA. A darkly stained area within the nucleus, called the **nucleolus** (plural = nucleoli), indicates the location where ribosomal RNA is made and comes together with specific proteins to form the ribosomal subunits. The ribosomal subunits are then transported through the nuclear pores into the cytoplasm, where they will be used for protein synthesis.