

BULK TRANSPORT

Many children love to play with soap bubbles. The bubbles look like small spherical structures flying in the air. Inside your cells, there are structures similar to these bubbles, and there are substances inside them destined to be transported either into or out of the cells, to be used by the body for important processes.

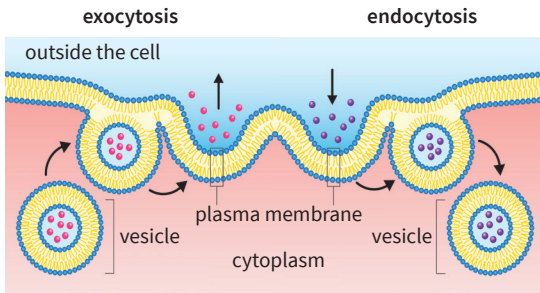


Fig. 3.11 Bulk transport of macromolecules by way of exocytosis and endocytosis.

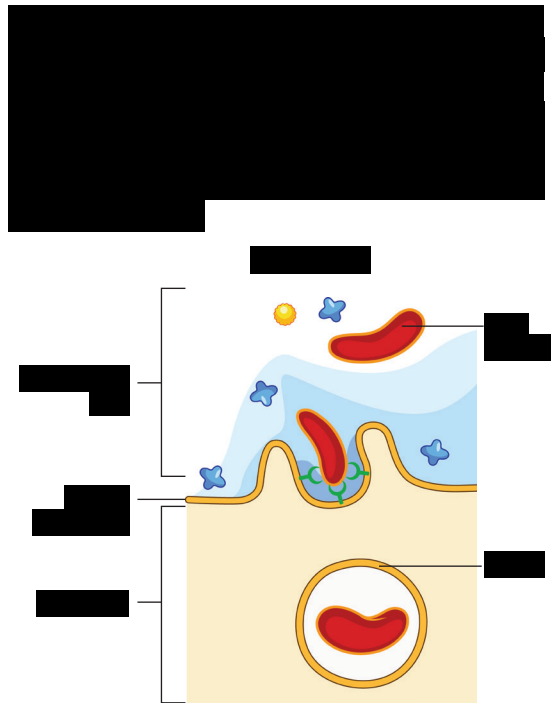
Large substances like polysaccharides and proteins that need to exit or enter the cell are transported using energy by way of vesicles, or membrane-bound, bubble-like vessels. Depending on the direction of transport, the “bubbles” may bud off from the plasma membrane in endocytosis or the Golgi apparatus in exocytosis (fig. 3.11).

Endocytosis

In endocytosis, a substance is taken in by the cell with a region of the plasma membrane enclosing it until a vesicle buds off. Then the vesicle fuses with lysosomes where digestion takes place, and the breakdown products diffuse from the lysosomal membrane into the cytosol for use or re-use (figs. 3.12 to 3.14). There are three kinds of endocytosis: phagocytosis, pinocytosis, and receptor-mediated endocytosis.

Phagocytosis

Imagine an invasion of a disease-causing bacterial population or pathogen into your system. When this happens, your body’s defense mechanism helps protect the body from the harmful effects of the invaders. The pathogen is eaten up by specialized white blood cells called *macrophages* through the process known as *phagocytosis* (Greek *phagein*, means “to eat”), a kind of endocytosis that involves the engulfment of large particles. The bacteria



Pinocytosis

From the Greek word *pinein*, which means “to drink,” *pinocytosis* is the kind of endocytosis that involves taking in small amounts of fluids with dissolved substances, creating a small vesicle that is about 150 nm in diameter. It is different from phagocytosis in terms of the size of the endocytosed substance, that is, it involves smaller molecules. An example of pinocytosis in humans is when egg cells take in nutrients from the surrounding cells.

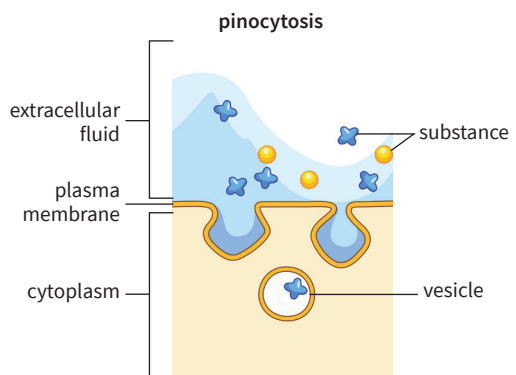


Fig. 3.13 Another way by which a cell carries out endocytosis is through pinocytosis where particles in solution are drawn in.

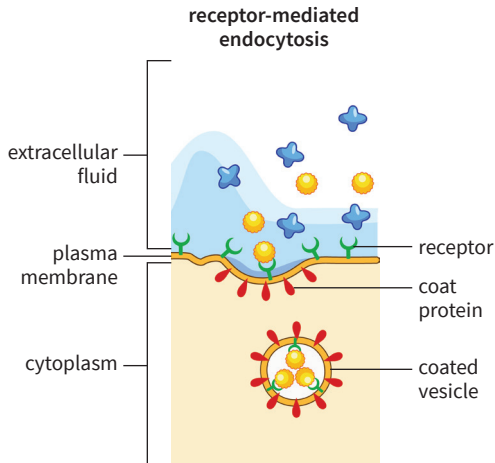


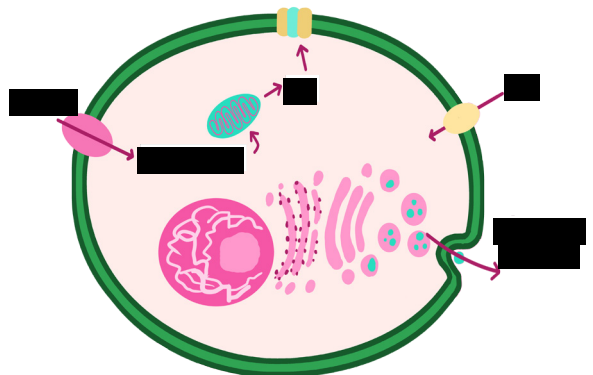
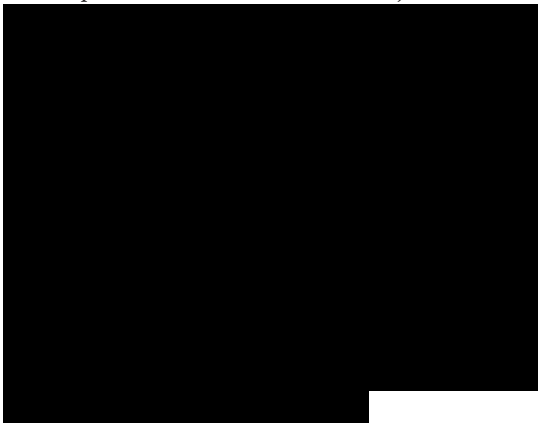
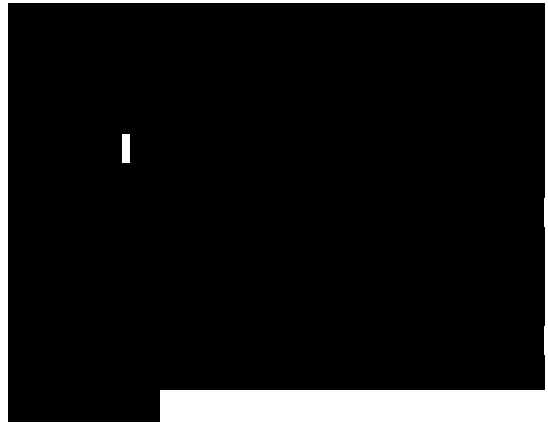
Fig. 3.14 In receptor-mediated endocytosis, a specific segment of the plasma membrane with coat proteins and receptors interact with particular substances and take them in.

Receptor-mediated Endocytosis

Receptor-mediated endocytosis involves the binding of substances from the external environment by receptors in the plasma membrane that are located in regions known as *coated pits*. At the cytosolic surface of coated pits are proteins called *clathrin*. After the complete engulfment of the substance, coated vesicles are formed. Clathrin detaches from the vesicles after a short while and returns to the plasma membrane. A vesicle joins with an

After a particular protein is synthesized in the rough ER, it moves to the Golgi apparatus for modification and sorting. Then it is enclosed by the membrane of the Golgi apparatus to form a small vesicle that travels to the plasma membrane. The vesicle fuses with the plasma membrane and releases its contents to the exterior of the cell.

Do you know someone who has diabetes? A person with diabetes has high blood sugar level and has glucose in the urine. This condition is brought about by flaws in the production or functioning of the protein *insulin*, a hormone that regulates blood sugar amount.



Exocytosis

The vesicular transport of substances from the Golgi apparatus to the external environment of the cell is called *exocytosis*. It is the reverse process of endocytosis.





**DID YOU
KNOW?**

Recently, researchers in Germany found that transport processes in cells are involved in uncommon but deadly liver failures in young children.

Using molecular techniques, they identified mutations in genes from patients and established a connection with the liver disease. The mutations

resulted in reduced amounts of protein product that is a component in transport processes involving vesicles inside the cells.