3.25: Exocytosis

Exocytosis is the reverse of endocytosis and that is just as well. In 30 minutes an active cell like a macrophage can endocytose an amount of plasma membrane equal to its complete plasma membrane. The electron micrograph in Figure 3.25.1 shows a guinea pig phagocyte ingesting polystyrene beads. Several beads are already enclosed in vacuoles while the others are in the process of being engulfed. So the cell must have a mechanism to restore the normal amount of plasma membrane. Exocytosis is that mechanism.

![Figure 3.25.1: Guinea pig Phagocyte courtesy Dr. Robert J. North](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_Biology_(Kimball)/Unit_03%3A_The_Cell/Module_3.25%3A_Exocytosis)

The Secretion Mechanism

Membrane-enclosed vesicles move to the cell surface where they fuse with the plasma membrane. This restores the
normal amount of plasma membrane and any molecules dissolved in the fluid contents of these vesicles are discharged into the extracellular fluid - this is called secretion (e.g., the various components of the extracellular matrix are secreted by exocytosis). Any integral membrane proteins exposed to the interior surface of the vesicles will now be displayed at the cell surface because the vesicles turn inside out as they fuse with the plasma membrane. Thus exocytosis does not simply replace plasma membrane, but ensures that the plasma membrane will display its characteristic cell-surface proteins.

![Exocytosis/Endocytosis](image)

**Figure 3.25.2: Exocytosis/Endocytosis**

Exocytic vesicles are created from several sources. Some are simply endosomes traversing the cell and others are pinched off from endosomes before they fuse with lysosomes. Others bud off from the endoplasmic reticulum and Golgi apparatus taking their products to the surface of the cell. The exocytosis of lysosomes supplies the membrane needed to repair wounds in the plasma membrane.

Some cells specialize in secretion. In cells that secrete large amounts of protein, for example, the protein accumulates in specialized secretory granules formed by the Golgi apparatus. These move to the cell surface and discharge their contents to the outside. For example, exocrine cells in the pancreas synthesize and secrete pancreatic digestive enzymes. The electron micrograph in Figure 3.25.4 shows four cells in the pancreas of a bat. The lumen where their apical surfaces meet leads eventually to the pancreatic duct draining into the small intestine. The spherical bodies (bud off from the Golgi apparatus) contain precursors of digestive enzymes. One is discharging its contents into the lumen by exocytosis (red arrow).

![Pancreas cells of a bat](image)

**Figure 3.25.4: Pancreas cells of a bat courtesy Fawcett, The Cell: Its Organelles and Inclusions, W. B. Saunders Co., 1966**
The cells lining our intestine synthesize tiny droplets of fat and discharge them into the lacteals by exocytosis.

The Kiss-and-Run Mechanism

The process described above involves the fusion of the exocytotic vesicle with the plasma membrane. In some cells, such as at synapses, a second type of exocytosis also takes place: (1) the vesicles make a brief contact at the plasma membrane, (2) release their contents (neurotransmitters in this case) to the exterior and (3) retreat back into the cytosol. This "kiss-and-run" version of exocytosis does not restore plasma membrane to the cell.

The Exosome Mechanism

A third type of exocytosis is found in some cells and involves endosomes themselves invaginating their membrane. As the invaginations break off they produce vesicles within vesicles, called multivesicular bodies. When these fuse with the cell's plasma membrane, these tiny (40–100 nm) internal vesicles — called exosomes — are secreted. Exosomes are produced in abundance by dendritic cells and B-cells and enhance their antigen-presenting function.

Figure 3.25.5: Exosomes

Contributors

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