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Physiology sheet

Doctor 2021 -mercy- I medicine I MU

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BULK FLOW

Why is bulk transport important for cells?

1- **There are materials that are too large to pass through the cell membrane using these methods.**
2- **Endocytosis and exocytosis are the bulk transport mechanisms used. As these transport processes require energy, they are known as active transport processes.**

Vesicle function in endocytosis and exocytosis

- **The walls of vesicles are made up of a lipid bilayer, which is why they are capable of fusing with the cell membrane.**

- **This fusion between vesicles and the plasma membrane facilitates bulk transport both into and out of the cell.**

Endocytosis:

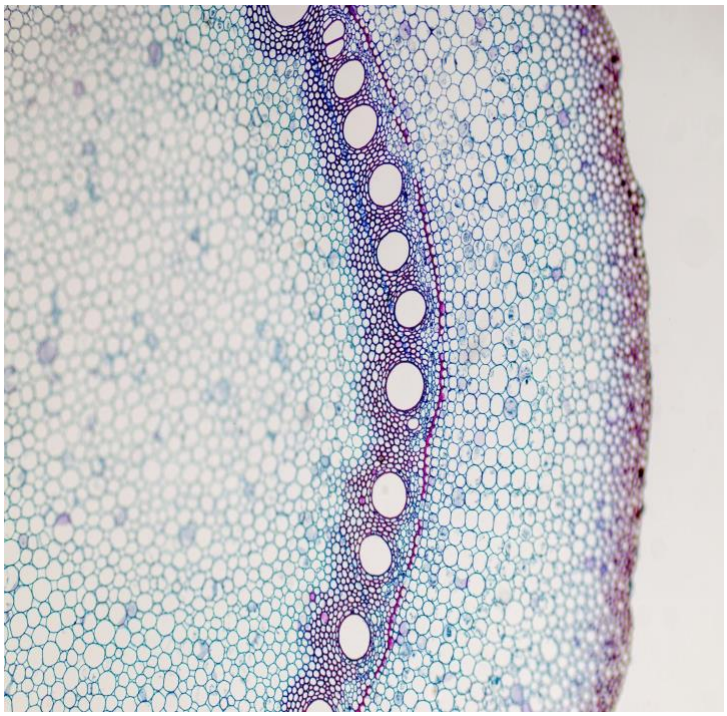
_ The process of moving substances from outside the cell to the inside.

_ carries an immune function.

Exocytosis:

_ The movement of substances from inside the cell to the outside

*** lock and key rule.**



The function of endocytosis?

- **Taking in nutrients for <u>cellular growth</u>, function and repair**
- **Capturing pathogens or other unknown substances that may endanger the organism**
  Get rid of foreign bodies (pathogens) attached to specific receptor on the cell membrane then get in the cell (destroyed inside the cell by lysosomes) . so it is used as immune response by cells such as macrophages.
- **Disposing of old or damaged cells**

The types of endocytosis:

☐ **Phagocytosis: specialized process (cellular eating)**

- **A particle or substance binds to receptors on the cell's surface, stimulating the release of pseudopodia (extensions of the plasma membrane filled with cytoplasm).**
  Pseudopodia are temporary presence of extensions of the plasma membrane to enable the ingestion of substances.
- **Pseudopodia surround the object until their membranes fuse, forming a phagocytic vesicle.**
- **The phagocytic vesicle pinches off from the cell membrane, entering the cell.**

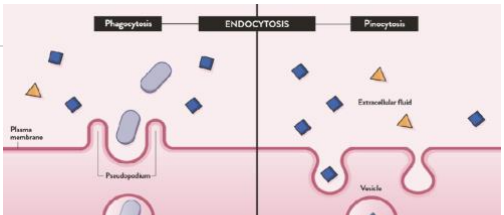
Depends on lock and key models.

Not all cells are capable of phagocytosis

An example of phagocytic cells are immune cells.

☐ **Pinocytosis (Cellular drinking):**
transport the droplets outside the cell into it through vesicles.

- **Molecules bind to receptors located along the surface of the cellular membrane.**
- **The plasma membrane folds in, forming a pinocytic vesicle that contains the molecules and the extracellular fluid.**
- **The pinocytic vesicle detaches from the cell membrane inside the cell.**
- **The vesicle fuses with early endosomes where the contents found within are sorted.**



Very small lipids have no way to enter the plasma membrane except through pinocytosis.

There are many types of pinocytosis and it is the only way to enter macro-molecules inside the cell.

Some types of pinocytosis doesn't need receptors (get in small substances) and other types need a specific receptors on the cell membrane to transport macromolecules which called receptor mediated endocytosis.

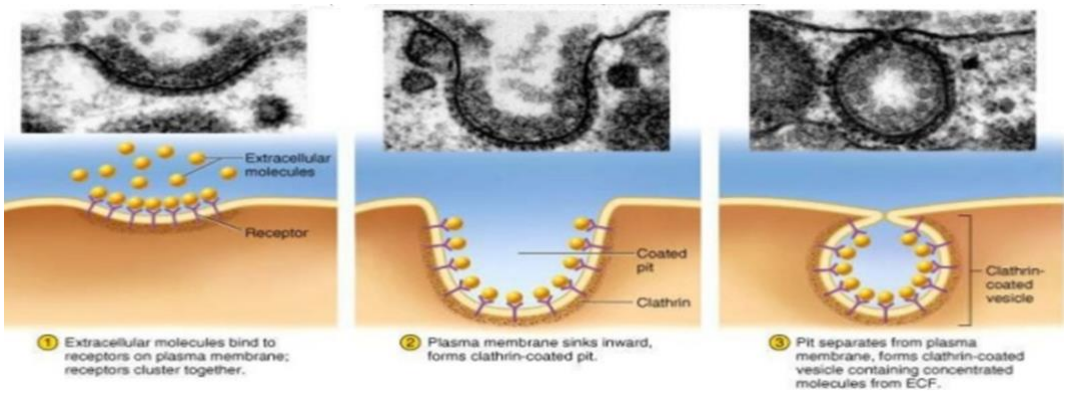
Receptors mediated endocytosis (selective process)

- **Involves formation of vesicles at surface of membrane**
  - **Vesicles contain receptors on their membrane**
  - **Vesicles contain specific target molecule in high concentration**
- **Clathrin-coated vesicle in cytoplasm**
  - **Uptake of LDL from bloodstream**
  - **If receptors are lacking LDL's accumulate and *hypercholestolemia* develops**

*** LDL (low density lipoprotein) tends to transport lipids fom liver to bloodstream, increasing in LDL amounts in the blood accumulates fats in blood vessels, forming plaques that hinder blood flow and decreasing oxygenation process in body cells, so LDL is called a lethal (killer). While high density lipids are good for the body, as it works the reverse process of LDL.**

*** underneath the receptors, clathrin is located.**

*** Clathrin has an important role in bringing substances and molecules closer to the surface of the cell membrane.**



* after the binding of molecules with the receptors, clathrin-pit begins to form, as a folding in the membrane occurs gradually. Pit(حفرة)

* step by step, clathrin-pit is altered into clathrin coated vesicle as the deepening of the pit inside the cell increases.

* Clathrin-coated vesicle is the most convenient way that is used to get rid of the macromolecules from the extracellular fluid, such as LDL.

Exocytosis

Exocytosis facilitates cellular communication by means of hormones.

serves the following purposes:

- Removing toxins or waste products from the cell's interior.
- Facilitating cellular communication
- Facilitating cellular membrane growth, repair , signaling and migration

The steps of exocytosis:

1. A vesicle is formed, typically within the endoplasmic reticulum and the Golgi apparatus or early endosomes.
2. The vesicle travels to the cell membrane.
3. The vesicle fuses to the plasma membrane, during which the two bilayers merge.
4. The vesicle's contents are released into the extracellular space.
5. The vesicle either fuses with or separates from the cell membrane.

Types of exocytosis

☐ Regulated Exocytosis

- Such as neurotransmitters or hormones.
- Once excreted from the endoplasmic reticulum, these vesicles are transported to the Golgi apparatus (also known as the Golgi complex) for further modification.
- The expulsion of the materials is controlled, or regulated, by extracellular signals that cause membrane depolarization.

Normally, during the rest the intracellular is negative compared to the outside of the cell . but in Depolarization the inside of the cell is positive compared to the outside.

☐ Constitutive Exocytosis

- **doesn't require any extracellular signals. Most molecules traveling to the plasma membrane do so using this pathway.**
- **some exocytotic vesicles are incorporated into the plasma membrane (full vesicle fusion)**
- **while others return to the interior of the cell after their contents have been released .**
- **Others remain docked to the membrane, where they can be used multiple times**

regulated and constitutive is not only concerned with exocytosis, it includes other types, so we classify pinocytosis as constitutive (doesn't require any extracellular signals) and the phagocytosis as regulated one (required signaling transduction).