TOPIC 2.6



#### **Membrane Transport**

#### <u>ENE-2.E.1</u>

Passive transport is the net movement of molecules from high concentration to low concentration without the direct input of metabolic energy.

#### <u>ENE-2.E.2</u>

Passive transport plays a primary role in the import of materials and the export of wastes.

TOPIC 2.6



#### **Membrane Transport**

#### <u>ENE-2.E.3</u>

Active transport requires the direct input of energy to move molecules from regions of low concentration to regions of high concentration.

#### <u>ENE-2.F.1</u>

The selective permeability of membranes allows for the formation of concentration gradients of solutes across the membrane.

TOPIC 2.6



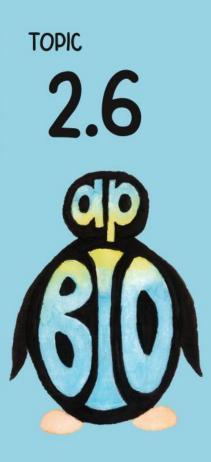
#### **Membrane Transport**

#### <u>ENE-2.F.2</u>

The processes of endocytosis and exocytosis require energy to move large molecules into and out of cells—

a. In exocytosis, internal vesicles fuse with the plasma membrane and secrete large macromolecules out of the cell.

b. In endocytosis, the cell takes in macromolecules and particulate matter by forming new vesicles derived from the plasma membrane.



## Passive transport moves substances...

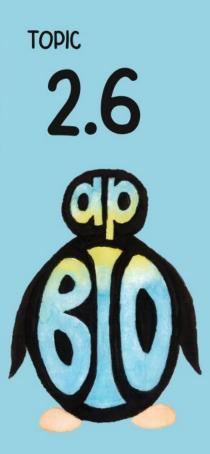
- A. From high to high concentration
- **B.** From high to low concentration
- **C.** From low to low concentration
- **D.** From low to high concentration

Passive transport moves substances...

B. From high to low concentration



Passive transport does not require ATP so it moves down its concentration gradient. This means that substances will move from high to low concentration.



#### Passive transport requires...

#### A. Energy input B. No energy input

Passive transport requires...

**B.** No energy input



#### Passive transport does not require any ATP input as the substance moves down its concentration gradient from high to low concentration.



#### Provide an example of passive transport

Provide an example of passive transport



#### Movement of water from hypotonic environment to hypertonic environment

Movement of glucose from blood to extracellular fluid after a meal.

Note: additional examples apply



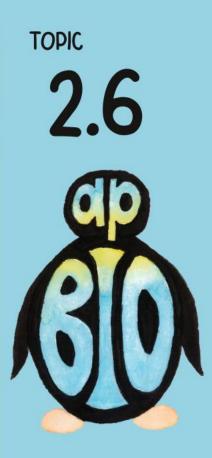
# What are the two types of passive transport?

What are the two types of passive transport?



#### Simple diffusion – does not require a membrane protein for transport

Facilitated diffusion – requires a transport protein



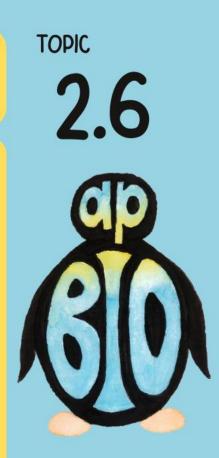
#### Active transport requires...

#### A. Energy

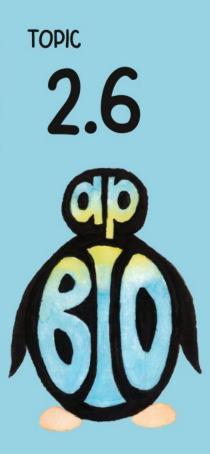
#### B. Transport protein C. Both energy & transport protein D. Neither energy nor transport protein

Active transport requires...

**C. Both energy & transport protein** 



### Active transport involves substances from moving from a low concentration to a high concentration. Due to the substance moving against its concentration gradient, the movement requires an input of energy.



#### Why does the active transport required energy & transport protein?

Why does the active transport required energy & transport protein?



Active transport is AGAINST the concentration gradient. This means that substances go from low concentration to high concentration. Imagine being at the bottom of a hill on a bike and you gotta get to the top of the hill... you gotta put some energy since you are from



# Process of exporting materials with vesicles?

#### A. Endocytosis

#### **B. Exocytosis**

#### **C. Facilitated Transport**

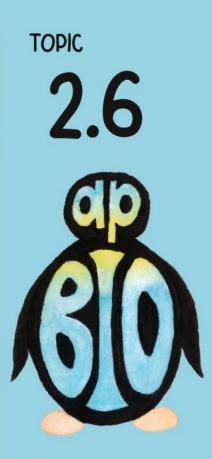
D. Simple Diffusion

Process of exporting materials with vesicles?

**B. Exocytosis** 



### Since there is a substance being exported, this process is called exocytosis. An easy way to remember this is that EXocytosis involves materials EXiting the cell.



# Where are the proteins made for export by exocytosis?

#### A. Golgi

- **B. Nucleus**
- C. Ribosome
- D. Rough ER

Where are the proteins made for export by exocytosis?

D. Rough ER



Proteins for secretion are made in the rough ER. The rough ER has membrane studded with ribosomes. Ribosomes synthesize proteins and since they are on a membrane, they made proteins for secretion (or membrane proteins)



# Describe the pathway for a protein to be exported.

Describe the pathway for a protein to be exported.



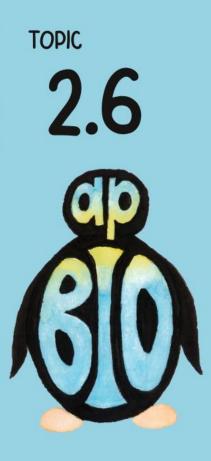
#### Rough ER Vesicle Golgi bodies/apparatus Vesicle Plasma Membrane



#### Describe the process of receptormediated endocytosis

Describe the process of receptor-mediated endocytosis

A ligand (signaling molecule) binds to a receptor protein. After signal transduction, the membrane undergoes invagination to create a "pit" that forms the vesicle.



# What does the product of phagocytosis bind to?

#### A. Endoplasmic Reticulum

#### B. Lysosome

#### C. Nucleus

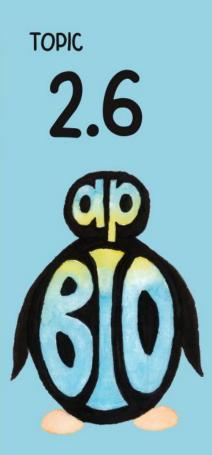
D. Mitochondria

What does the product of phagocytosis bind to?

**B.** Lysosome



Phagocytosis is cellular eating. The pseudopods surround the food particle creating the food vacuole which fuses with the lysosome for digestion.



#### Amount of ATP used to move 30 moles of glucose down concentration gradient

### A. O moles ATP

- B. 15 moles ATP
- C. 30 moles ATP
- D. 60 moles ATP

Amount of ATP used to move 30 moles of glucose down concentration gradient

TOPIC 2.6

A. O moles ATP

### This was a "trick" question. The glucose is moving down its concentration gradient which is PASSIVE transport. Passive transport does NOT require ATP.



### What type of movement requires no energy, down concentration gradient

# A. Active transportB. Passive transport

What type of movement requires no energy, down concentration gradient

**B.** Passive transport



Passive transport does not require any ATP as the material is moving down its concentration gradient. The substances are moving from high concentration to low concentration.



#### What is the difference between facilitated transport and simple diffusion?

What is the difference between facilitated transport and simple diffusion?



### Facilitated transport requires a transport protein.

Simple diffusion does not require a protein and passes directly through the plasma membrane.

Both are passive transport and do NOT require an input of ATP.



#### Identify two components of active transport

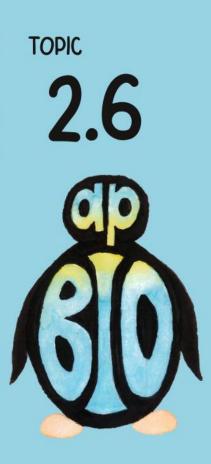
Identify two components of active transport

TOPIC 2.6

Active transport moves materials against the concentration gradient.

Active transport requires use of ATP

Active transport requires a transport protein (traditionally a carrier protein)



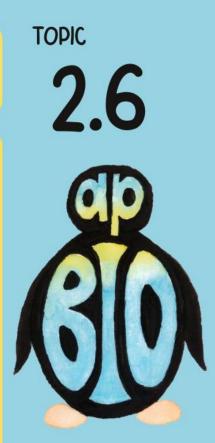
#### Move glucose from GI tract into blood supply. Identify type of transport used.

A. Active

- **B.** Facilitated
  - C. Simple

Move glucose from GI tract into blood supply. Identify type of transport used.

**B. Facilitated** 



Glucose is a polar substance. Due to its polar nature, it requires assistance to cross the membrane. If a protein is helping material to cross the membrane, this is considered facilitated diffusion.



### Movement of oxygen from alveoli (lungs) into blood supply Identify type of transport used.

- A. Active
- **B.** Facilitated
  - C. Simple

Movement of oxygen from alveoli (lungs) into blood supply. Identify type of transport used.

C. Simple

TOPIC 2.6

Oxygen is small and nonpolar. This means that it is able to cross the plasma membrane without assistance. In addition, in the lungs the oxygen will be entering the blood supply so it will be moving down its concentration gradient.



### Sodium/potassium pump moving 3 Na+ out and 2 K+ into neuron (nervous cell) Identify type of transport used.

A. Active

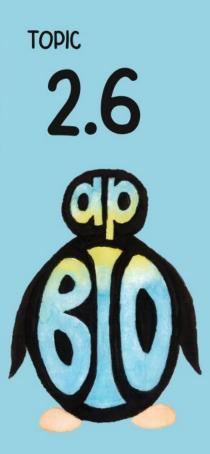
- **B. Facilitated** 
  - C. Simple

Sodium/potassium pump moving 3 Na+ out and 2 K+ into neuron (nervous cell). Identify type of transport used.

A. Active

TOPIC 2.6

Sodium and potassium are charged which means they are polar. They are being "pumped" which means it is going against its concentration gradient which describes active transport.



### Secretion of proteins from rough ER is done by

### A. Exocytosis B. Facilitated Transport C. Simple Diffusion

Secretion of proteins from rough ER is done by

A. Exocytosis



EXocytosis is the process of materials EXiting the cell. After the materials are made in the rough ER, they are sorted and modified in the Golgi, then released by fusing with the plasma membrane.



# Identify and describe the three types of endocytosis.



Identify and describe the three types of endocytosis.

Endocytosis is bulk transport across the plasma membrane.

Phagocytosis – cellular eating, pseudopodia surround "food" to be engulfed by the cell

Pinocytosis – cellular drinking, cell "gulps" extracellular fluid and solutes it contains

Receptor-Mediated Endocytosis – ligand binds to receptor causing invagination to move material across membrane

# 

#### Pathway to exocytosis

- A. Rough ER ⇒ Golgi ⇒ Membrane
  - **B.** Rough ER  $\Rightarrow$  Lysosome  $\Rightarrow$

#### Membrane

C. Smooth ER  $\Rightarrow$  Golgi  $\Rightarrow$ 

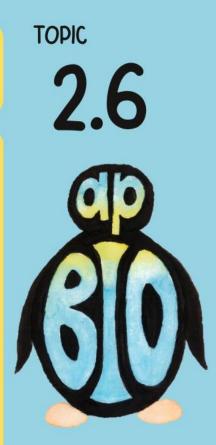
#### Membrane

D. Smooth ER ⇒ Lysosome ⇒ Membrane

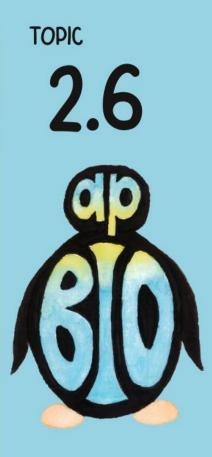
#### Membrane

Pathway to exocytosis

A. Rough ER ⇨ Golgi ⇨ Membrane



The materials are synthesized by the ribosomes on the rough ER membrane. The materials are sorted and modified by the Golgi bodies. The materials are secreted by the transport vesicles fuses with the membrane.



#### Pathway of phagocytosis

- A. Membrane 🖙 Golgi 🖙 Rough ER
  - **B. Membrane** ⇒ Golgi ⇒ Smooth

#### ER

- C. Membrane 🖙 Lysosome
- D. Membrane 🖙 Rough ER

Pathway of phagocytosis

C. Membrane ⇒ Lysosome



### Phagocyosis is cellular eating. After the food vacuole is formed from the phagocytosis, it will fuse with the lysosome for digestion.