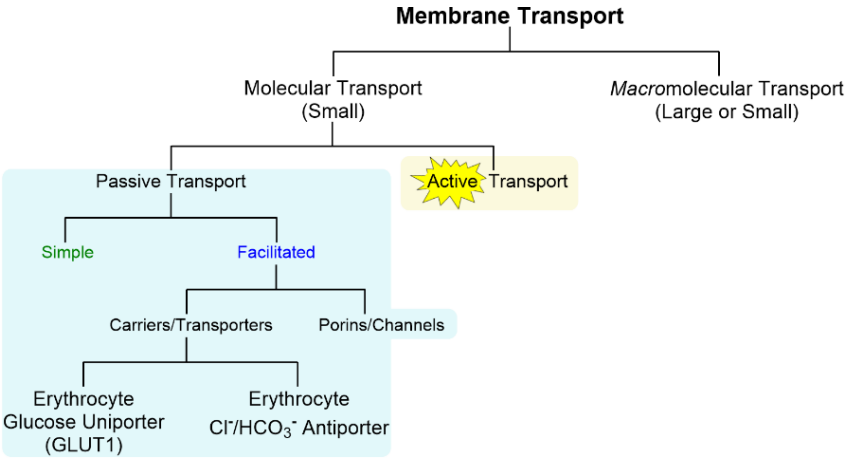
CONCEPT: ERYTHROCYTE FACILITATED TRANSPORTER MODELS

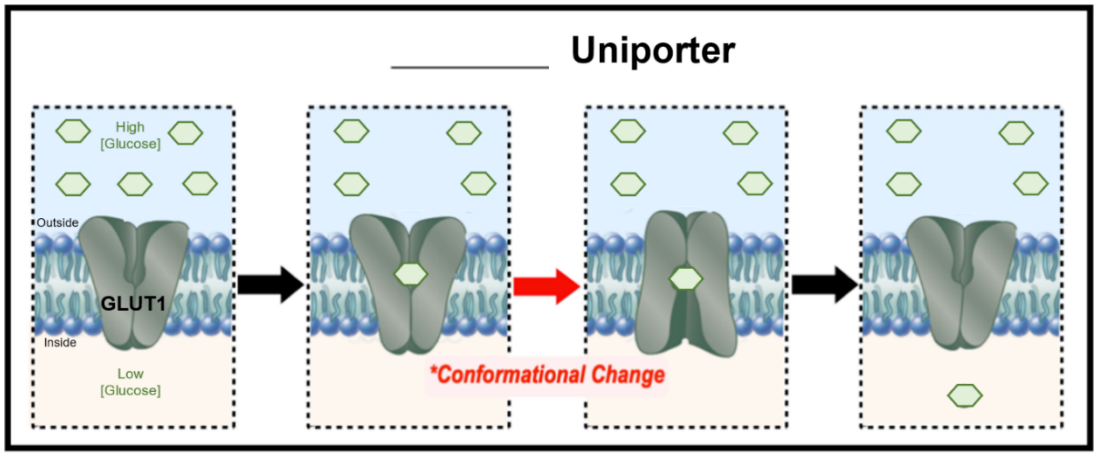


Erythrocyte Glucose Uniporter (GLUT1)

●Classic example of *facilitated passive transport* are erythrocyte (red blood cell) *Glucose Transporters* (_____).

□ GLUT1 *conformationally changes* as it transports glucose *down* its concentration gradient as a _____.

□ Due to glucose metabolism, [Glucose] inside cells is generally kept _____ with respect to blood [glucose].



□ _____ glucose transporters exist in *different* tissues with *varied* functional roles.

Transporter	Tissue Expression	Biological Role
_____	Ubiquitous	Basal Glucose Uptake
GLUT2	Intestine, Liver, Pancreas	*Intestine*: Pump digested glucose into blood. *Liver*: replenishes blood glucose. *Pancreas*: Regulation of insulin release
GLUT4	Muscle, Fat, Heart	Glucose import, increased by insulin

PRACTICE: Glucose transport into erythrocytes (not into intestinal epithelial cells) is an example of:

a) Primary active transport.
b) Secondary active transport.
c) Facilitated symport.
d) Facilitated Uniport.
e) Simple Diffusion.
f) None of the above.

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PRACTICE: Which of the following correctly ranks the steps of erythrocyte glucose transport by GLUT1?

a) II, I, III, IV. b) II, I, IV, III. c) IV, III, II, I d) I, II, IV, III. e) IV, II, III, I

I. A conformational change exposes glucose to the opposite site of the membrane.

II. Glucose binds to the transporter on one side of the membrane.

III. The GLUT1 transporter reverts back to its initial conformation.

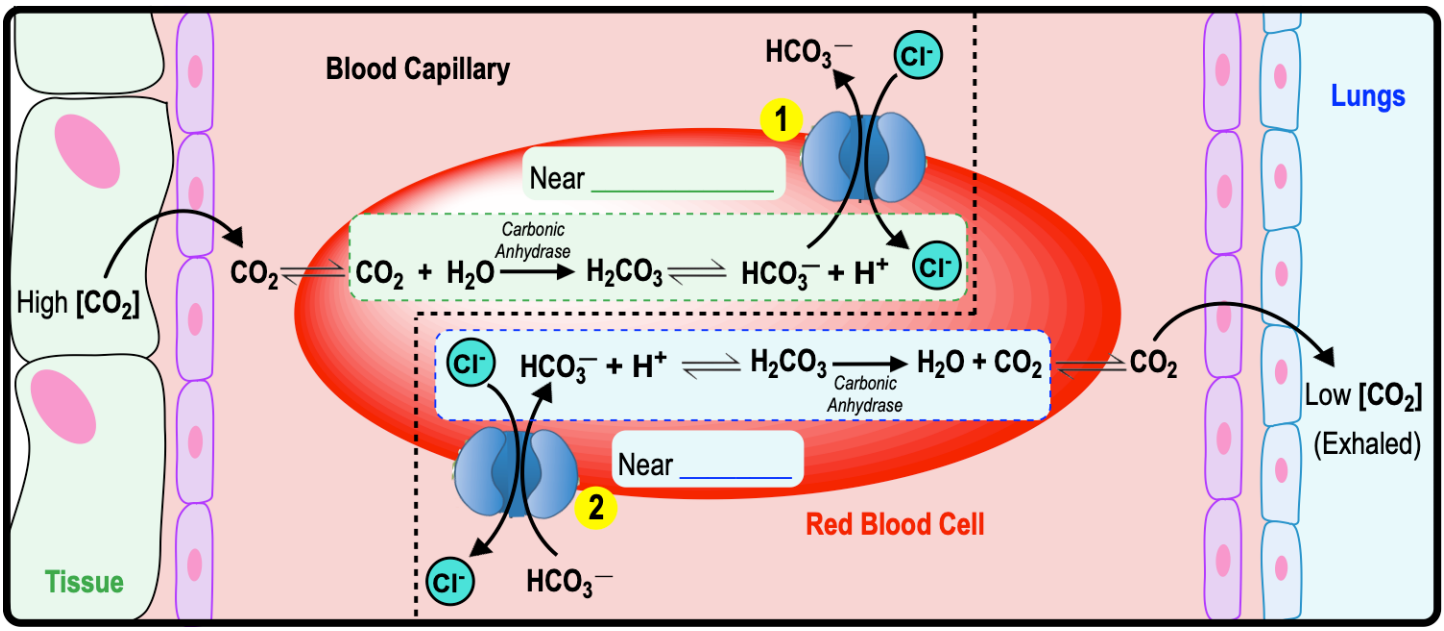
IV. The glucose molecule has a weakened affinity to GLUT1 and dissociates from the transporter.

Erythrocyte Cl^-/HCO_3^- Antiporter

- Recall: CO_2 produced by respiring tissues *diffuses* into erythrocytes, where _____ *anhydrase* converts it to HCO_3^-.
  - □ *Cl^-/HCO_3^- Antiporters:* passively transport Cl^- & HCO_3^- in _____ directions (called *Chloride-*_____).
- *Chloride-Shift*: phenomenon of Cl^-/HCO_3^- _____ near the *tissues* & near the *lungs*.
  - □ Cl^- acts as *counterion* to _____ charge across membrane.
  - □ HCO_3^- buffer *maintains* blood pH & _____ *blood's capacity to transport CO_2* from tissues to lungs.

How Does the Chloride-Shift Work?

1. Near *tissues*, ↑ $[HCO_3^-]$ *inside* cell diffuses *down* its gradient to the _____ (via Cl^-/HCO_3^- antiporters).
2. Near *lungs*, the _____ events occur.



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PRACTICE: What is the chloride shift?

a) The excretion of Cl^- by the kidney, preventing bicarbonate ions from causing an increase in plasma pH.
b) The production of carbaminohemoglobin by chloride infusion from the plasma.
c) The exchange of Cl^- for bicarbonate ions in erythrocytes, causing HCO_3^- to leave the cell.
d) The production of bicarbonate by enzymatic degradation of chloride.

PRACTICE: The Chloride-Shift occurs when:

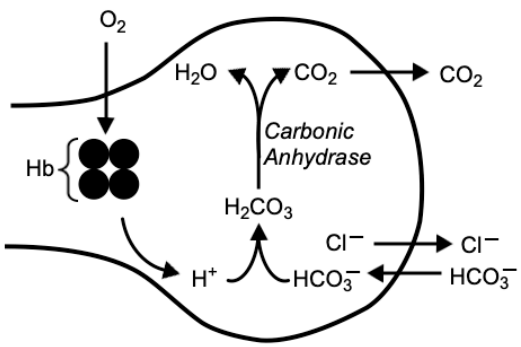
a) Carbon dioxide moves into the RBCs.
b) Hemoglobin binds carbon dioxide.
c) Oxygen moves into the red blood cells.
d) Bicarbonate moves out of the red blood cells.
e) Chloride shifts across the nuclear membrane.

PRACTICE: Which of the following statements is FALSE concerning the chloride-bicarbonate exchanger?

a) The exchanger increases the rate of bicarbonate transport across the membrane.
b) The exchanger uses ATP as an energy source to drive bicarbonate transport.
c) The exchanger transports chloride ions across the membrane.
d) The exchanger is classified as an antiporter.

PRACTICE: In the "chloride shift" diagrams below, label each scenario (**A** & **B**) as occurring in either the tissues or lungs:

A) a) Tissues. b) Lungs.



B) a) Tissues. b) Lungs.