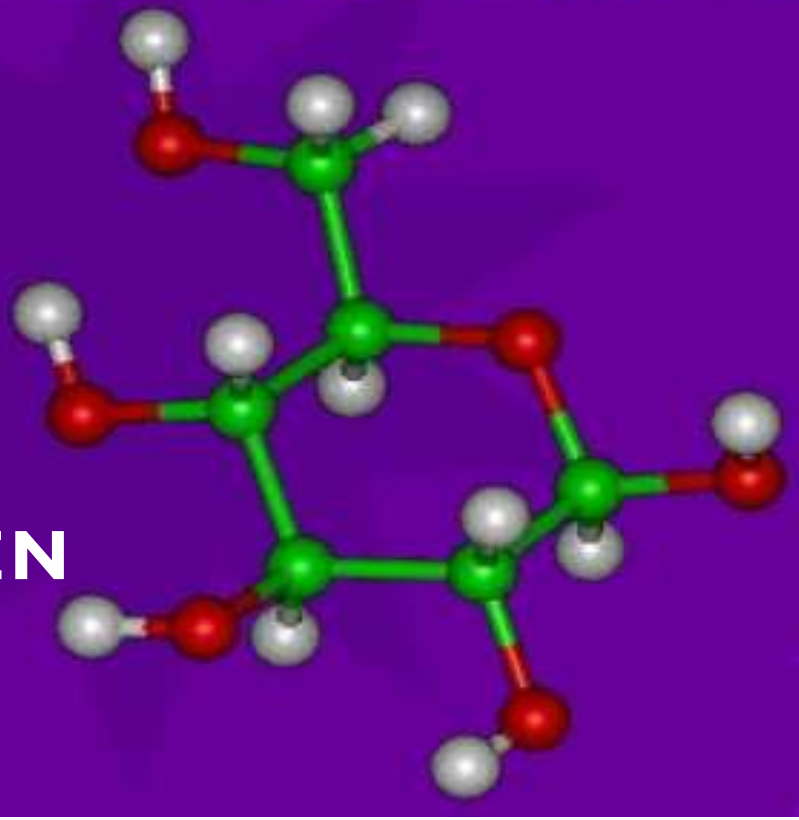
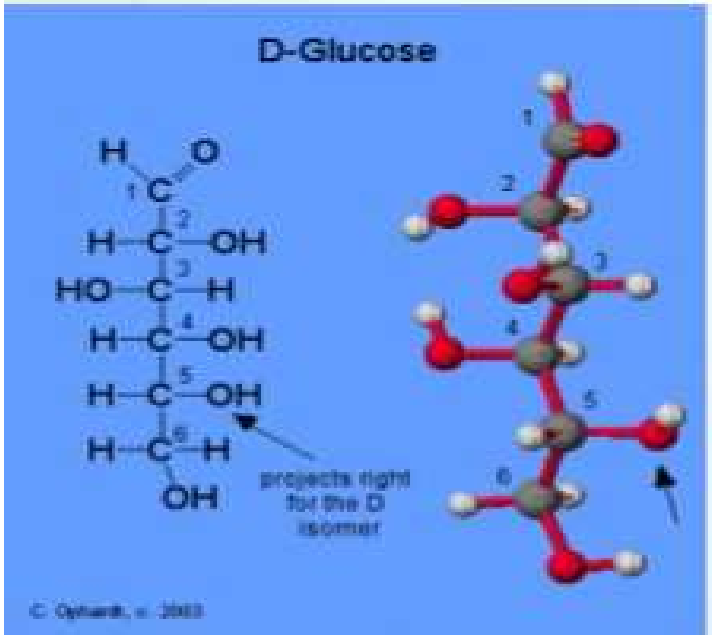
GLUCOSE TRANSPORT



DR. SOBIA NOREEN

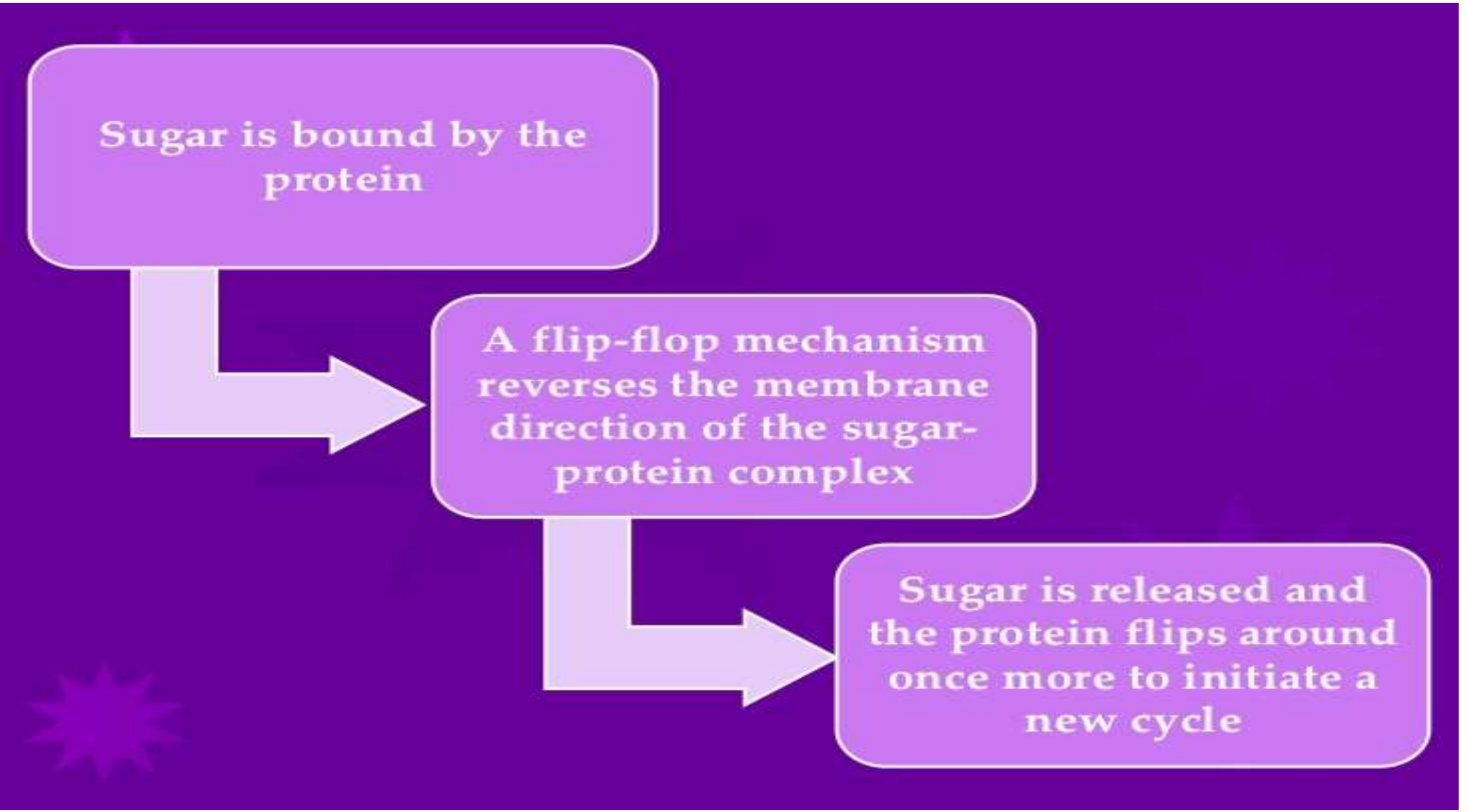
Introduction
Glucose



Glucose is the most common carbohydrate .Glucose is called **blood sugar** as it circulates in the blood at a concentration of 65-110 mg/100 ml of blood. Glucose is an important fuel for contracting muscle, and normal glucose metabolism is vital for health. Glucose enters the muscle cell via facilitated diffusion through the GLUT4 glucose.

Synthesis of Free Glucose

- Most non-autotrophic cells are unable to produce free glucose because they lack expression of glucose-6-phosphatase and, thus, are involved only in glucose uptake and catabolism.
- Usually produced only in hepatocytes, in fasting conditions other tissues such as the intestines, muscles, brain, and kidneys are able to produce glucose following activation of gluconeogenesis.


Sugar is bound by the protein
A flip-flop mechanism reverses the membrane direction of the sugar-protein complex
Sugar is released and the protein flips around once more to initiate a new cycle

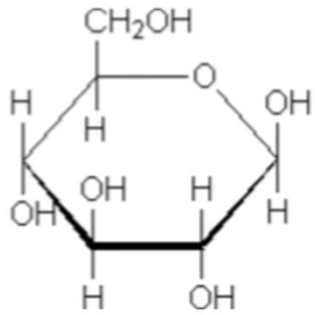
- In most tissues the internal glucose concentration is quite low; transport can only proceed from the extracellular area into the cell.
- In gluconeogenetic tissues (liver and kidney), intracellular glucose concentration can exceed blood glucose concentration in the post-absorptive or fasting states.

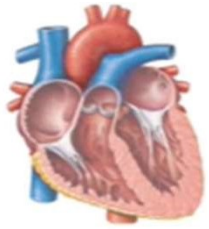
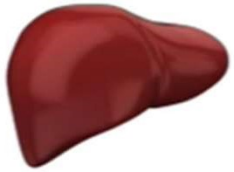
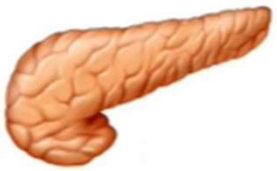
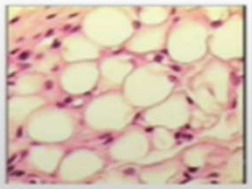
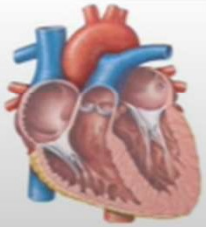
Glucose transporters

- Glucose transporters are integral membrane glycoproteins with molecular masses of about 50,000 daltons, and each has 12 membrane-spanning α-helical domains.
- Transporter exposes a single substrate binding site toward either the outside or the inside of the cell.
- Binding of glucose to one site provokes a conformational change associated with transport, and releases glucose to the other side of the membrane.

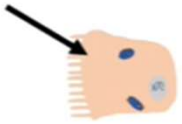
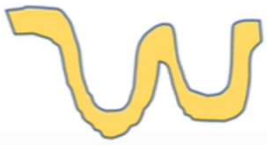
Types of Glucose Transporters

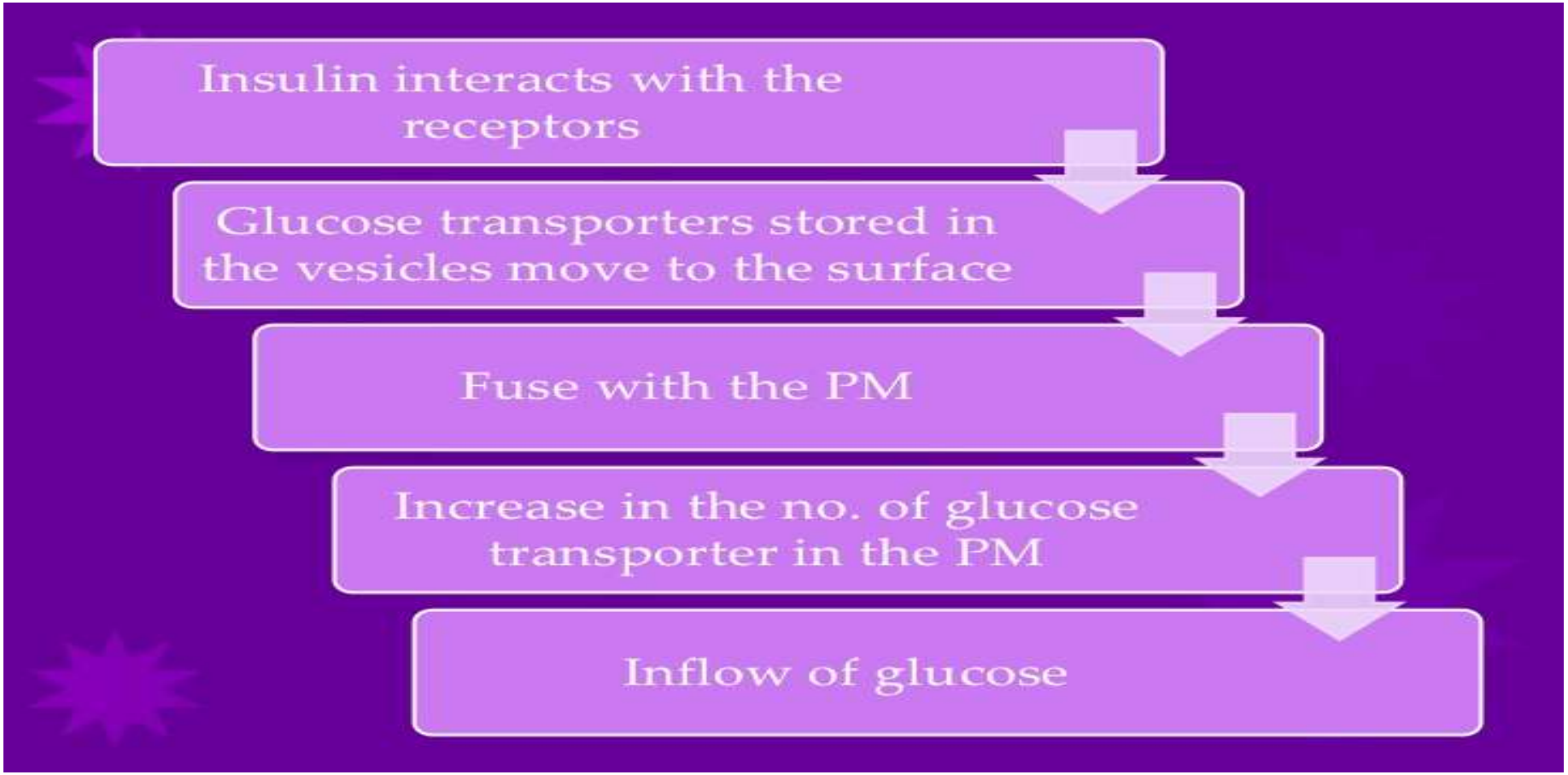
- Glucose is hydrophilic
- Two types of transporter:
  - **GLUTs**
    - 14 Different Types
    - Sodium and ATP-independent
    - Ubiquitous
  - **SGLTs**
    - Sodium-Dependent
    - Require ATP
    - **Blood brain barriers**



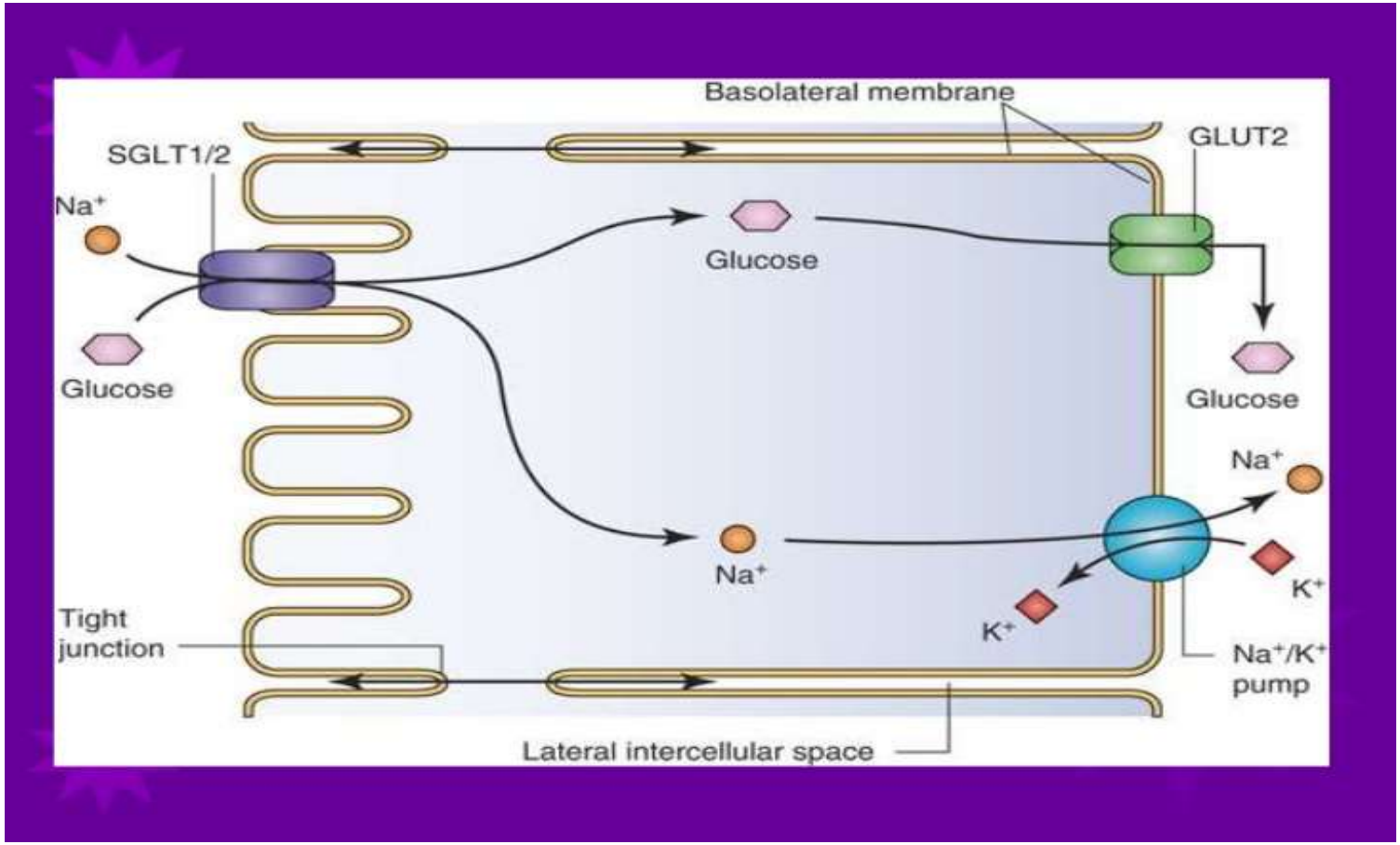
GLUT1	• Blood • Blood-Brain Barrier • Heart (lesser extent)  	• Insulin-Independent
GLUT2	• Liver • Pancreas • Small Intestine  	• Insulin-Independent • High K_m • Low Affinity
GLUT3	• Brain • Neurons • Sperm 	• Insulin-Independent • Low K_m • High Affinity
GLUT4	• Skeletal Muscle • Adipose Tissue • Heart   	• **<u>Insulin-Dependent</u>** • Moderate K_m • Moderate Affinity
GLUT5	• Enterocyte of Intestinal Epithelium (Luminal Side) 	• Insulin-Independent • *Fructose Transporter*

Sodium-Dependent Glucose Transporters

SGLT1	• Enterocytes of Intestinal Epithelium (Luminal side) 	• Insulin-Independent • ATP- and Na-dependent • *Glucose Absorption*
SGLT2	• Proximal tubule of nephron (Kidney) 	• Insulin-Independent • ATP- and Na-dependent • *Glucose Retention*


Insulin interacts with the receptors
Glucose transporters stored in the vesicles move to the surface
Fuse with the PM
Increase in the no. of glucose transporter in the PM
Inflow of glucose

- Insulin level drops → glucose transporters are removed from the PM by endocytosis and stored in vesicles.
- Faulty regulation: Type 2 Diabetes Mellitus


Basolateral membrane
SGLT1/2
GLUT2
Na+
Glucose
Glucose
Glucose
Na+
Na+
K+
K+
Tight junction
Na+/K+ pump
Lateral intercellular space

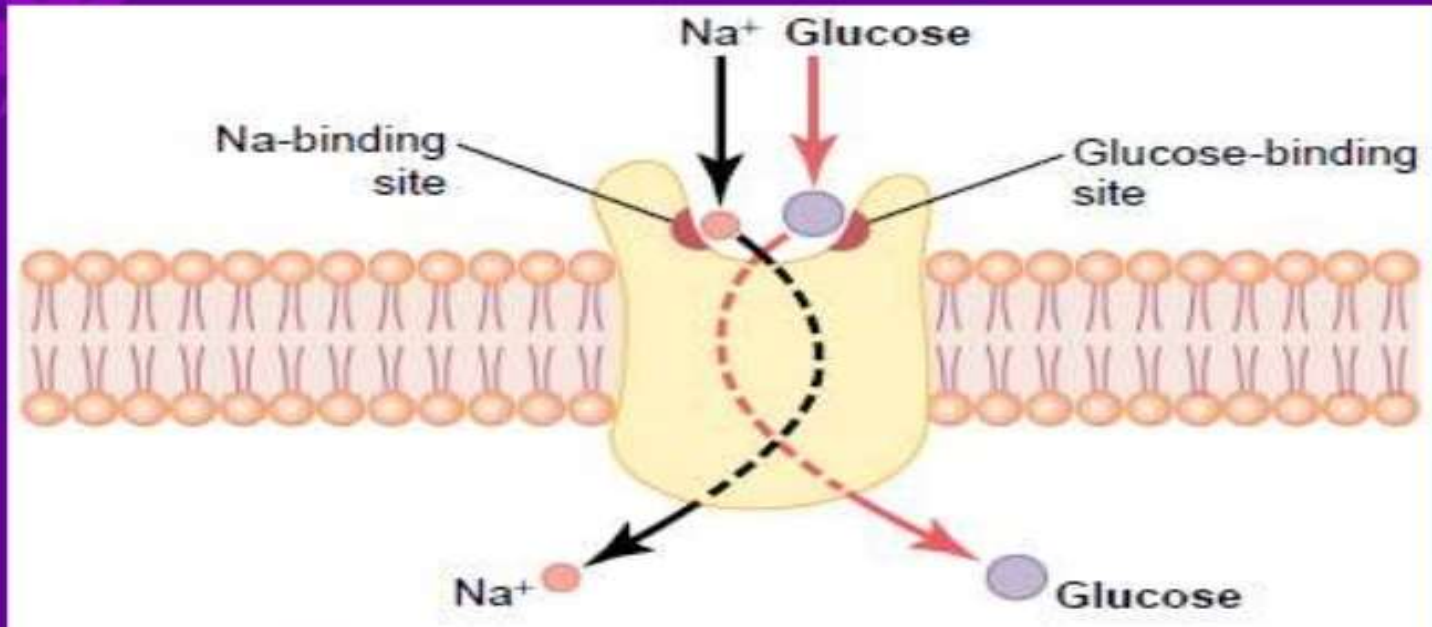


Figure 4–12

Postulated mechanism for sodium co-transport of glucose.