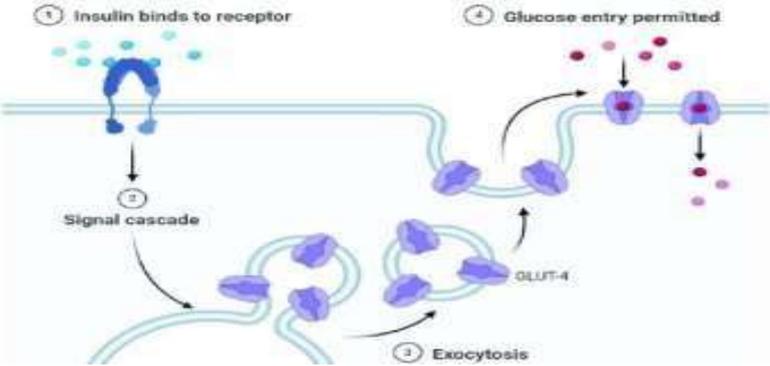
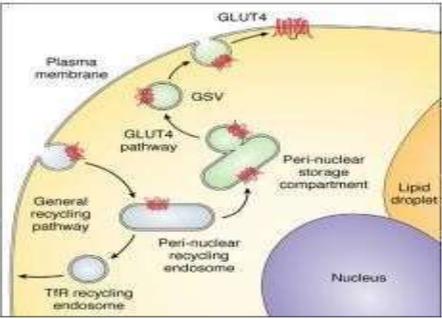
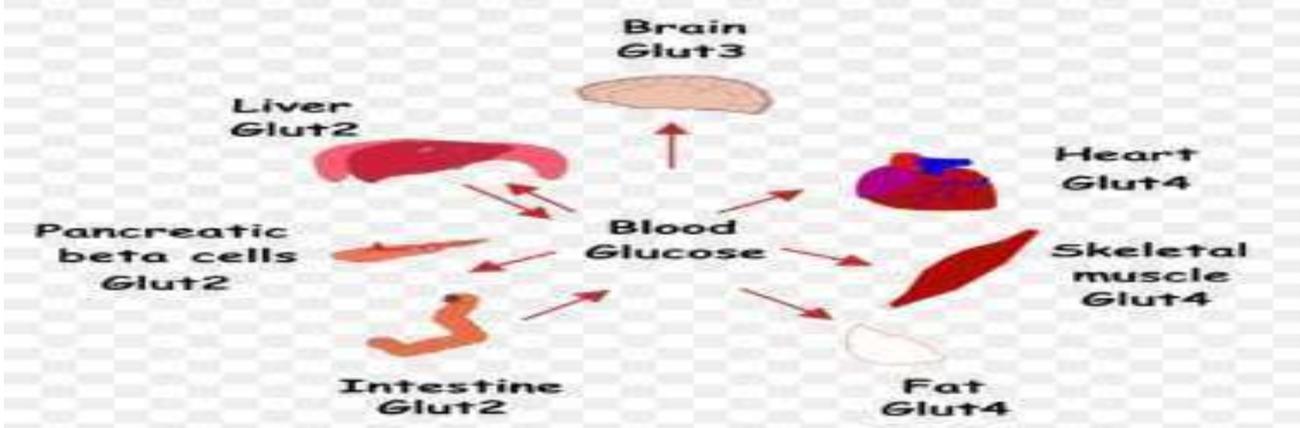
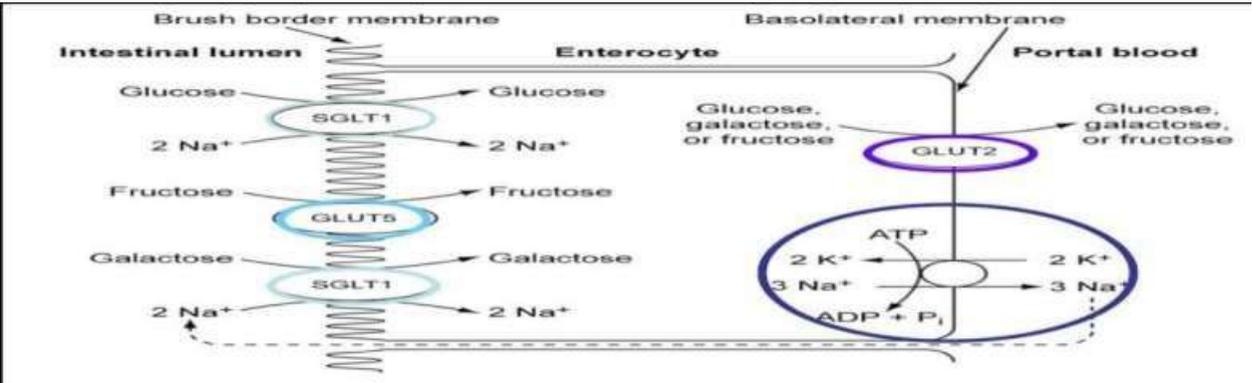


TD 1 Metabolic regulation
3rd Biochemistry

Question 1 :

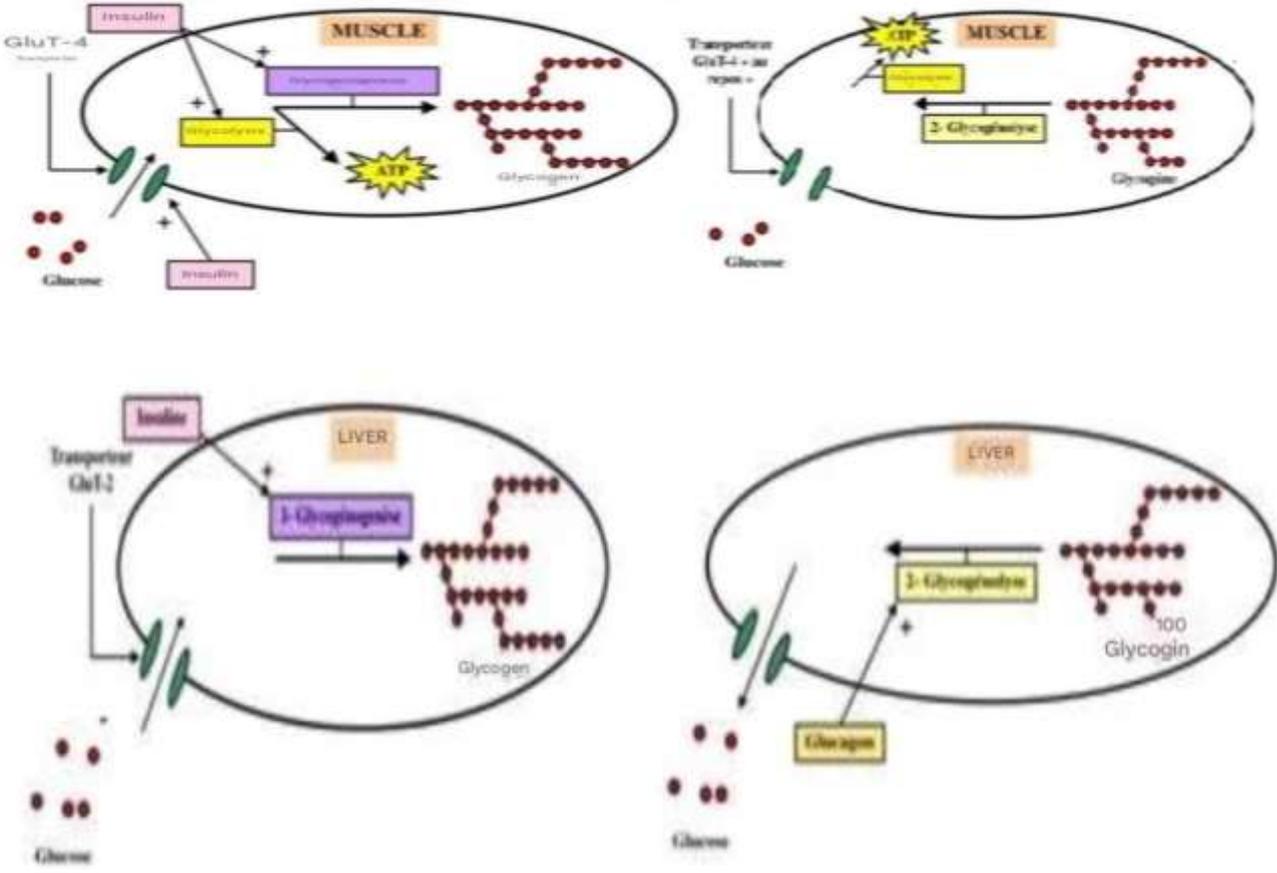
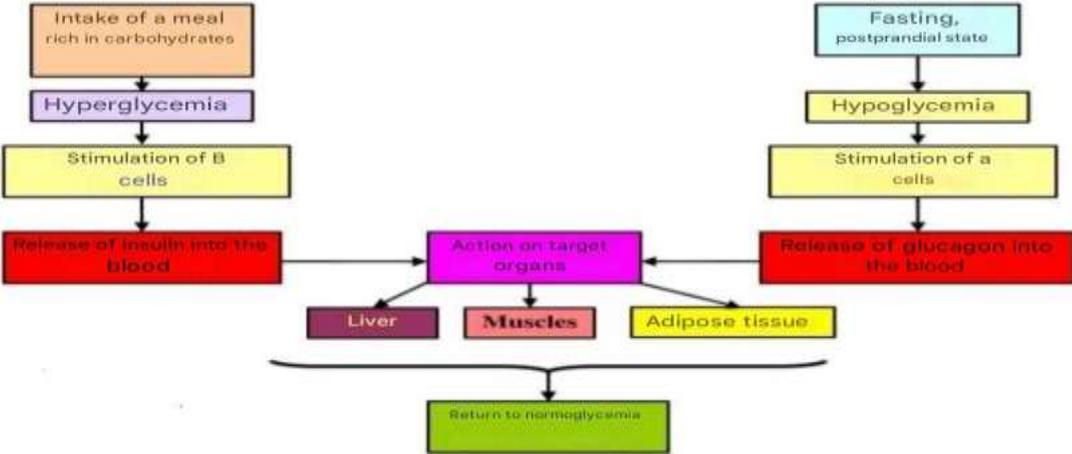
- List the two types of transporters that carry glucose into the cell according to the diagrams below.
- Explain the differences that may exist between the different transporters.
- What is the effect of insulin on the GLUT4 protein?



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Question 2

Give the information acquired as possible according to the diagrams below?



Question 1

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Glucose cannot enter the different cells by simple diffusion. Its entry is ensured by the following two mechanisms:

- **Facilitated transport:** Five membrane glucose transporters, called GLUTs, are currently known, numbered from 1 to 5. **GLUT-1 to GLUT-5**. These proteins share some homology in their initial sequences but subsequently exhibit sequences specific to their membranes of residence. In the first image, GLUT-5 can move fructose in the intestinal cell. Once inside the intestinal side, these sugars are moved into blood by another transporter, GLUT-2, to be transported to the body's cells for energy and storage.

- **Sodium glucose cotransport (SGLT1):** This type of transport is an active process that **consumes energy**. Glucose is transported against **the gradient**. Glucose and Na⁺ are transported in the same direction and at the same time across the membrane. This type of transport occurs in epithelial cells, in the intestine, in the kidney, etc. SGLT-1 moving galactose sugar, using sodium gradient.

Thus, GLUT-4 is abundant in adipocytes and striated muscle cells, while erythrocytes are rich in GLUT-1. The number and activity of GLUT-4 are increased by insulin.

-**The differences between GLUTs transporter and SGLT1**

Transporter	Present in	Properties
GluT1	RBC, Brain, Kidney, Colon, Retina, Placenta	Glucose Uptake In Most Of Cells
GluT2	Serosal Surface Of Intestinal Cells, Liver Beta Cells Of Pancreas	-Low Affinity -Glucose Uptake In Liver -Glucose Sensor In Beta Cells
GluT3	Neurons, Brain	-High Affinity -Glucose Into Brain Cells
GluT4	Skeletal, Heart Muscle, Adipose Tissue	Insulin Mediated Glucose Uptake
GluT5	Small Intestine, Testis, Sperms, Kidney	-Fructose Transporter -Poor Ability To Transport Glucose
GluT7	Liver Endoplasmic Reticulum	Glucose From ER To Cytoplasm
SGLuT	Intestine, Kidney	Cotransport - From Lumen Into Cell

Increased glucose entry into muscle and adipose tissue by stimulating the synthesis and translocation of GLUT-4 receptors. Insulin's main activity is to promote glucose entry into insulin-sensitive tissue cells. At the level of its target cells, this hormone facilitates glucose penetration into the cytoplasm by improving the permeability of their membrane through recruitment of GLUT-4 glucose receptors. Insulin stimulates the enrichment of the plasma membrane with GLUT4 transporters. To achieve this, vesicles containing the transporters fuse with the membrane.

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Question 2

- Hypoglycemic or hyperglycemic hormonal factors regulate blood sugar fluctuations to maintain its concentration as close as possible to its physiological value. In the basal state, at rest and while fasting, blood sugar levels range from 0.7 to 1.1 g per liter of blood. The pancreas acts as a detector of blood sugar fluctuations. In cases of hyperglycemia, it secretes insulin (a hypoglycemic hormone) from the β cells of the islets of Langerhans; in cases of hypoglycemia, it secretes glucagon (a hyperglycemic hormone) from the α cells of the islets of Langerhans. This regulation provides an intense and rapid response to blood sugar fluctuations.

-Insulin exerts its activity primarily on the liver, muscles, and adipose tissue. The first step in insulin's action on target organs occurs through its binding to specific membrane receptors.

At the liver cell level:

HYPERGLYCEMIA (Insulin)

- Glucose enters the cell via GLUT2 transporters
- Insulin stimulates hepatic glycogenogenesis.

HYPOGLYCEMIA (Glucagon)

- Glucose release through glycogenolysis and gluconeogenesis (stimulation by Glucagon)
- The only organ capable of maintaining blood sugar levels by releasing glucose into the blood

At the muscle cell level:

HYPERGLYCEMIA (Insulin)

- Glucose enters the cell via GLUT4 transporters
- Insulin stimulates muscle glycogenogenesis.

HYPOGLYCEMIA (Glucagon)

- Does not release glucose produced by glycogenolysis (Glucose 6 phosphatase enzyme deficiency)
- Glucose is consumed by this cell via glycolysis for muscle contractions
- GLUT 4 is at rest

At the adipocyte cell level:

HYPOGLYCEMIA (Glucagon)

- Stimulation of lipolysis
- Triglycerides are hydrolyzed into fatty acids and glycerol.
- Fatty acids provide energy to cells suffering from hypoglycemia.
- The glycerol formed will replenish glucose during gluconeogenesis.
- GLUT 4 is at rest.

HYPERGLYCEMIA (Insulin)

- Glucose enters the cell via GLUT4 transporters.
- Insulin stimulates lipogenesis and triglyceride synthesis