GLYCOGENESIS

Glycogenesis is the synthesis of glycogen from glucose in the cytoplasm. Glycogenesis helps the cell to form and store a readily mobilizable polysaccharide. The latter is used in maintaining the blood sugar level inspite of variation in the food intake and during the first 24 hours of fasting. It also contributes to the enErgy production during intense activity.

Location:

i.In the liver and muscle cells

ii.Brain and kidneys also carry out some Glycogenesis and store.

Progressive biochemical steps involved:

1.Formation of glucose-6-phosphate

i.Glucose is phosphorylated to glucose-6-phosphate in presence of ATP, Mg^{2+} and hexokinase/ glucokinase.

ii.This enzyme transfers the terminal ϒ-phosphate group of the Mg^{2+}-ATP complex to the C^6-hydroxyl group of glucose.

Q.What is the difference between glucokinase and hexokinase activity?

Glucokinase, an inducible enzyme acts specifically on glucose for which it has a far higher Km than *Hexokinases*. Thats why **glucokinase** catalyses glycogenesis and glucose uptake only at higher sugar level (100mg dl^{-1} or higher- after having a meal) . Glucokinase predominates over **hexocikanases** in the liver. Hexokinase predominate in *extahepatic tissus* and their low Km for glucose (50µM)helps muscles to take up glucose even at low blood sugar levels.

2.Formation fo glucose-1-phosphate

i.Phosphoglucomutase isomerizes glucose-6-phosphate to **glucose-1-phosphate** in presence of Mg^{2+}.

ii.The enzyme first transfer a phosphate group from a **phosphoserine** residue of its active site to the C^1 of glucose-6-phosphate to change the latter to the enzyme-bound **glucose 1,6-biphosphate** intermediate.

iii.Then the glucose1,6-biphosphate transfers a phosphate group from the C^6 of the intermediate to the serine residue at the active site, changing the serine back to **phosphoserine** and producing glucose-1-phosphate.

3.Formation of Uridinediphosphoglucose(UDP-Glucose)

i.UDP-glucose phosphrylase catalyzes a reaction between glucose 1- phosphate and uridine triphosphate (UTP).

ii)Two terminal phosphate groups of UTP are released as inorganic pyrophosphate (PPi) and glucose-1-phosphate occupies their place to form UDP-glucose.

iii)Inorganic **pyrophosphatase** hydrolyses PPi and this drives the reaction towards the synthesis of UDP-Glucose.

4.Formation of glycogen amylase

i.Transfer of glucose form UDP-glucose—Glycogen synthase can transfer glucose from UDP-glucose to the **nonreducing end** of a preexisting-**oligosaccharide**.

ii.At initiation phase glycogen synthase uses a protein, **glycogenin** as the initiating primer and transfers the glucose from a UDP-glucose to the OH group of a tyrosine residue of **glycogenin** (the C^1 of the glucose residue of glucose gets linked with the Tyr-OH by a O-glycosidic bond)

iii.Transfer of glucose molecule— A second glucose molecule is transferred from another UDP-glucose molecule to the C^4 of the glycogenin-bound glucose, this is followed by similar additions of successive glucose molecuyle to the nonreducing end of the growing oligosaccharide, held by glycogenin.