Glycogenolysis

Glycogen+breakdown= Breakdown of glycogen

Site

Tissue site- Liver and Muscle

Intracellular site- Cytosol

Starting material- Glycogen.

End Product- Glucose in Liver
Glucose-6-phosphate in muscle.

Glycogenolysis is the breakdown of glycogen in glucose molecules. It takes place in three steps. There are two enzymes involved in the whole process, one is Glycogen Phosphorylase which is the main enzyme for the breakdown of glycogen and the another enzyme is the branching enzyme.

1. The first step is the removal of terminal glucose at the non-reducing ends by attack of inorganic phosphate. This reaction is catalysed by the enzyme glycogen phosphorylase, in the presence of pyridoxal phosphate. The glucose molecules removes are in the form of α-D-Glucose-1-phosphate.
   There are several non - reducing ends in a glycogen molecule and hence this process starts simultaneously from all the non - reducing ends. This point validates that as much as the number of branches in glycogen has, it can breakdown with a much faster speeit can fulfill the glucose demand of the blood quickly.

   2. Now, by removing glucose molecules from non - reducing ends the Glycogen Phosphorylase reaches at a point, which are four glucose residues away from the branch point. At this step, the action of Glycogen Phosphorylase stops. Now, the transfer of branch is done with the help of the **Branching Enzyme that is Oligo α (1→6) to α (1→ 4) glucose transferase** transferase in two ways.
   a. First step is the **transferase** activity when the De-branching enzyme transfers three glucose residues from the branch to its main chain.
   b. In second step at the branch point, the only remaining glucose molecule at the branch is removed by the **glucosidase** activity of the de-branching enzyme.

2. Again Glycogen Phosphorylase breaks glucose molecules from the non - reducing ends till the next branch point comes. In this way several Glucose 1 phosphate molecules are released. Now these **Glucose 1 phosphate molecules are converted back into Glucose 6 phosphate molecule** with the help of the enzyme

phosphoglucomutase.

3. At last, if necessary, the Glucose 6 phosphate molecule can convert into glucose molecules only in liver or kidney with the help of the enzyme Glucose 6 phosphatase and the glucose molecules can now be sent in the bloodstream. The whole process can be illustrated as follows: (fig will be given)

Significance of glycogenolysis

Hepatic glycogenolysis takes place in order to maintain blood glucose level.
Muscle glycogenolysis takes place for the provision of energy.

Regulation of glucogenolysis

Glycogen Phosphorylase is the regulalatory enzyme of glycogenolysis. The phosphorylated form of glycogen phosphorylase is active whereas de-phosphorylated form is inactive. Glycogen phosphorylase activity is activated by glucagon and adrenaline, inhibited by insulin.