

301
Carbohydrates

Glycogen Metabolism (Essay 15)

* synthesis.

* degradation.

* homopolysaccharide with glucose units.

• α 1,4 linkage (straight line) and α 1,6

linkage (branching points are present)

• stored in liver and muscle.

• liver glycogen provide glucose during fasting*

• muscle glycogen act as reserve glucose

fuel for muscle contraction.

Glycogenesis. {synthesis}.

• Occurs mainly in liver & muscle.

1. Activation of glucose.

• UDP glucose is formed from glucose - 1P & UTP by the enzyme UDP-glucose pyrophosphorylase.

UDP-glucose pyrophosphorylase.

Glucose

↓ Hexokinase

Glucose - 6 - phosphate.


↓ phosphoglucomutase.

Glucose - 1 - phosphate.

↓ UDP - glucose pyrophosphorylase

UTP → PPi

↓ UDP - glucose.

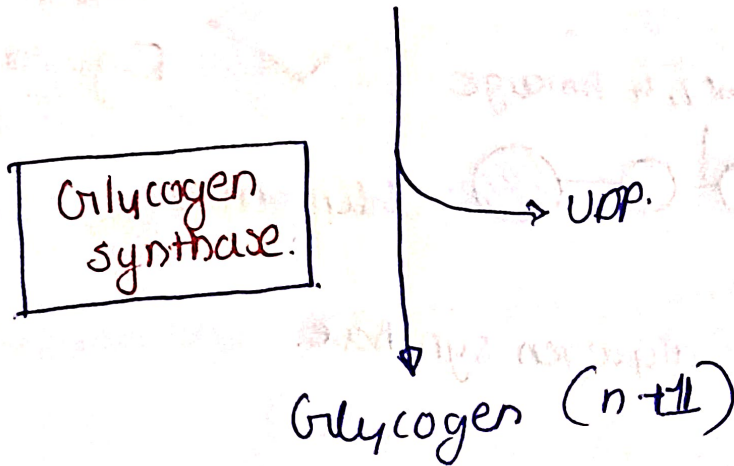


2. Action of glycogen synthase

- 'glycogen primer' - glycogenin must be present to initiate the reaction.
- Glycogenin is a protein-carbohydrate complex.
- molecular weight : 37 kDa.
- Dimer having two identical monomers
- An oligosaccharide chain of 7 glucose units are present in each monomer.
- monomers glycosylating each other using UDP glucose.
- Glycogen synthase adds activated glucose units to non reducing end of glycogenin to form α 1,4 glycosidic linkage.

• UDP is released.

UDP - Glucose + Glycogen primer (n)



3. Action of Branching Enzyme.

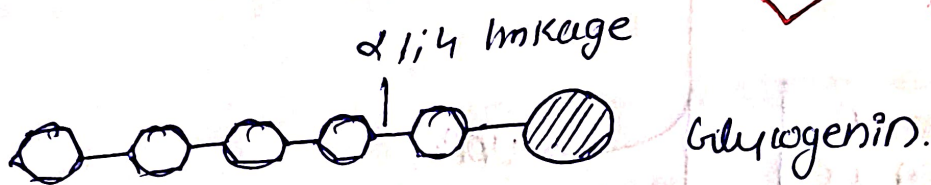
Branching enzyme (amylase - [1,4] → [1,6] transglucosidase)

• Branching enzyme is needed to create the α 1,6 linkage.

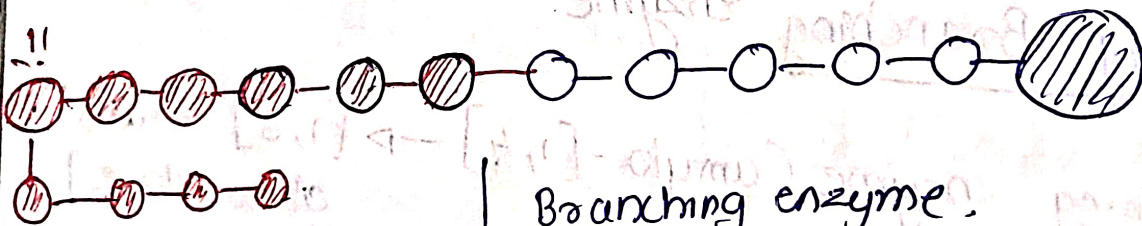
• When the chain is at least 11 glucose residues long, branching enzyme transfers a part of the α (1,4) chain (at least 6 glucose residues) to a neighbouring chain to form a 1,6 linkage, branch point.

• To this newly created branch, further glucose units can be added in a $\alpha(1\rightarrow4)$ linkage by glycogen synthase.

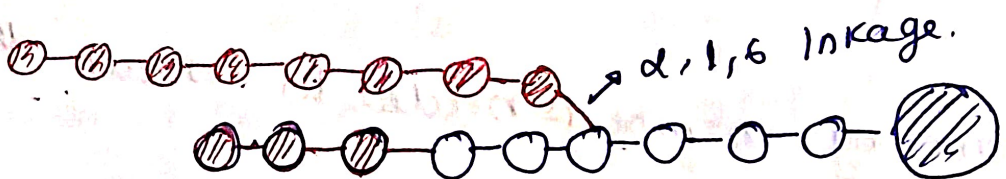
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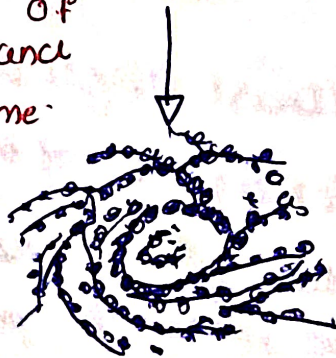
+ UDP glucose. \downarrow glycogen synthase.



\downarrow Branching enzyme.



combined action of glycogen synthase and branching enzyme



Tree like structured Glycogen.