Hello everyone, this module is a part

of Unit 3 carbohydrate metabolism.

The module name is carbohydrate metabolism.

Glycogenolysis I am Ms. Karishma Vaman Naik assistant professor from Department of Zoology,

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In this module, we're going to learn

about structure of glycogen and

reactions involved in glycogenolysis.

By the end of the module,

student will be able to describe the

structure of glycogen and explain the steps

in reactions involved in glycogenolysis.

Glycogen is a homopolymer of

glucose containing up to 55

to 60,000 glucosyl residues.

It consists of linear chains

of glucose linked side by side

by A14 glycosidic bonds,

and the chains are highly branched

with a A16 branch linkages occurring

after every eight to 10 residues.

The end of the molecule containing the

free numeric carbon that is a free

aldehyde group is called the reducing end.

On the other hand,

it and the other end is called

the nonreducing end.

In this picture you can see the A14

glycosidic bond and the Alpha 161.

This bond leads to formation of branches.

Glycogenolysis is the degradative

pathway that mobilizes stored glycogen

in liver and skeletal muscle.

It is not a reversal of the anabolic

pathway that is glycogenesis.

Glycogen breakdown is enhanced when glucose

concentration and energy levels are low.

The primary product during

degradation of glycogen is glucose

phosphate that is obtained by

breaking the A14 glycosidic bonds,

the free glucose,

which is released from each.

A16 linked glucosyl residue.

The steps of glycolysis are

shortening of chains, that is,

glycogen phosphorolysis.

Removal of branches, conversion of

glucose phosphate to glucose 6 phosphate,

and free glucose formation.

So in this picture you can see glycogen is.

Acted upon by the glycogen phosphorylase

that removes 1 glucose residue,

so the glycogen that we get after

that is having one residue less.

Giving us glucose 1 phosphate that

is acted upon by another enzyme

giving us glucose 6 phosphate.

This glucose 6 phosphate in

the endoplasmic reticulum is

converted to free glucose that is

released into the bloodstream.

The first step that is shortening

of chains of glycogen includes the

rupture or breakage of A14 glycosidic

bonds by insertion of a phosphate

at carbon one of glucose unit at

the nonreducing ends of the chain.

This addition of phosphate at

carbon yields glucose phosphate.

This step utilizes inorganic phosphate

instead of phosphate from ATP and is

catalyzed by glycogen phosphorylase enzyme.

The PHOSPHOROLYSIS stops 4 glucose

residues before and A16 junction and the

resulting structure is called a limit.

Dextrin and the phosphorylase

cannot degrade it any further.

In this picture you can see by

the help of inorganic phosphate,

a phosphate group is added at the

carbon one position leading to

formation of glucose 1 phosphate

and the resultant glycogen chain

is with one less glucose group.

So this process stops 4 glucose

residues before the branching.

The branches are removed by the two

enzymic activities of a single bifunctional

protein known as debranching enzyme.

The two enzymic activities are by

Oligo A14 to A14 glucose transferase

and a Milo A16 glucosidase.

The first enzyme removes the outer

three of the four glucosyl residues,

a test at a branch which are transferred to

the nonreducing end of the another chain.

Thus, an A114 bond is broken

and an Alpha 140 bond is made,

and the enzyme functions as

a four to four transferase.

As the name itself suggests that it breaks

A1 for bond and creates A1 for bond.

In this picture you can see that

the four residues which remain by

phosphorolysis just before the A16 bond.

Three of those are removed.

That is, this A14 bond is broken

and another A14 bond is created

to a parallel chain.

This activity is by the four

to four transferase activity,

amylo alpha glucosidase enzyme

removes the remaining single glucose

residue in an A16 linkage by

hydrolysis to yield free glucose.

The glucose will chain is now available

for degradation again by the first step,

that is by the glycogen phosphorylase

enzyme until 4 glucosyl units from

the next branch are reached, so.

This glucose in residue is acted

upon by the Amylo A16 glucosidase

enzyme and this bond is broken,

so we have a free glucosyl or free

glucose residue made next step is

conversion of glucose phosphate

to glucose 6 phosphate.

The first step of this pathway yields a

lot of glucose 1 phosphate in the cell.

This is converted into glucose 6

phosphate by phosphoglucomutase.

This is the reverse reaction that.

Produces glucose 1 phosphate in glycogenesis.

In the laevo,

glucose 6 phosphate is transported

into the endoplasmic reticulum by

glucose 6 phosphate translocase,

and there it is acted upon by

the phosphoglucomutase.

The intermediate formed in this

reaction is glucose 6 bisphosphate.

The last stage of like generalizes

the hydrolysis of glucose 6 phosphate

to glucose and inorganic phosphate.

The glucose 6 phosphate

catalyzes this reaction.

It is the same enzyme used in the

last step of gluconeogenesis.

The glucose produced then moves from

endoplasmic reticulum to the cytosol

and hepatocytes release glycogen,

derived glucose into the blood

to maintain blood glucose levels

until the gluconeogenic pathway

is actively producing glucose.

So this is the last step where glucose

6 phosphate is converted to glucose,

releasing 1 inorganic phosphate molecule.

So this picture summarizes the

entire process of glycogen breakdown,

where glycogen phosphorylase acts first

to produce glucose 1 phosphate,

and the phosphorylase activity

further produces.

Lot of glucose 1 phosphate residues

so that the glycogen chain is short

and the phosphorylase activity stops

near to the branching .4 residues

away from the branching point.

And the glucose 1 phosphate

produced is converted to glucose,

and we have free glucose in the cell.

The regulation of like geniuses

and glycogenolysis glycogenesis is

controlled by enzyme glycogen synthase,

whereas glycogenolysis is controlled

by glycogen phosphorylase 3 regulatory

mechanisms that regulate these

enzymes are allosteric regulation,

hormonal regulation,

and influence of calcium.

These are my references.

Thank you.