**UNIT-2-Pentose phosphate Pathway**

The pentose phosphate pathway is a biochemical process that occurs in the cytoplasm of human cells and is common to all organisms; it has several important roles. Pentose phosphate pathway is important to maintain carbon homeostasis is to provide precursors for nucleotides in amino acid biosynthesis to provide reducing molecules for anabolism and to defeat oxidative process. It is also called the **Phosphogluconate pathway or the hexose monophosphate pathway.**

It provides a way for the cells to oxidize glucose to create NADPH. Unlike in a NADH, NADPH contains a phosphorylated two hydroxyl group on one of the ribose units.

1.NADPH is used as a reducing agent in-
fatty acid biosynthesis
nucleotides biosynthesis.
cholesterol biosynthesis,
neurotransmitter biosynthesis.

- 2. It provides a way to break down pentose sugar obtained from the diet.

3. It provides a way to synthesize pentose sugar ( ribose) that are incorporated into bio molecules such as DNA RNA, ATP,NADH,FAD II and coenzyme A.

**The pentose phosphate pathway consists of two phases**
**a. Oxidative phases**
**b. Non-oxidative phases**

The oxidative branch is highly active in most eukaryotes and converts glucose -6 - phosphate into carbon dioxide, ribulose- 5 -phosphate and NADPH..

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The first reaction of the pentose phosphate pathway is the oxidation of glucose -6- phosphate by **glucose- 6- phosphate dehydrogenase** to form 6- phosphoglucono-$^{\delta}$-lactone and intramolecular ester. The lactone is hydrolysed to the free acid 6- phosphogluconate by specific **lactonase**, then 6-phosphogluconate undergoes oxidation in decarboxylation by 6- phosphogluconate dehydrogenase to form ketopentose ribulose- 5- phosphate, the reaction generates second molecule of NADPH. Phosphopentose isomerase converts ribulose- 5 -phosphate to its aldose isomer, ribose 5 phosphate.
So, the first phases of PP pathway generate 2 NADPH molecules and a pentose sugar called ribose-5-phosphate. When needed, the ribose-5-phosphate can be used to create DNA,RNA and nucleotide based molecules.

The non -oxidative branch metabolize the glycolytic intermediate Fructose -6- phosphate and glyceraldehyde -3 -phosphate as well as sedoheptulose sugar yielding ribose -5- phosphate for the synthesis of nucleic acid and sugar phosphate precursor for the synthesis of amino acid.

Or
When the cell needs NADPH much more than ribose-5-phosphate, it can convert the pentose sugar into glycolytic intermediate via the non-oxidative phase. In the second step, a xylulose-5-phosphate transfers a two carbon group onto a ribose-5-phosphate.This generates a triose(GAP). And a heptose (sedoheptulose). This is catalysed by

**transketolase,** which uses a cofactor called **thiamine pyrophosphate (TPP).** The 3rd step converts Glyceraldheyde-3-phosphate (GAP) and sedoheptulase into a hexose(fructose-6-phosphate). And a tetrose (Erythrose). This is catalysed by **transaldose**.