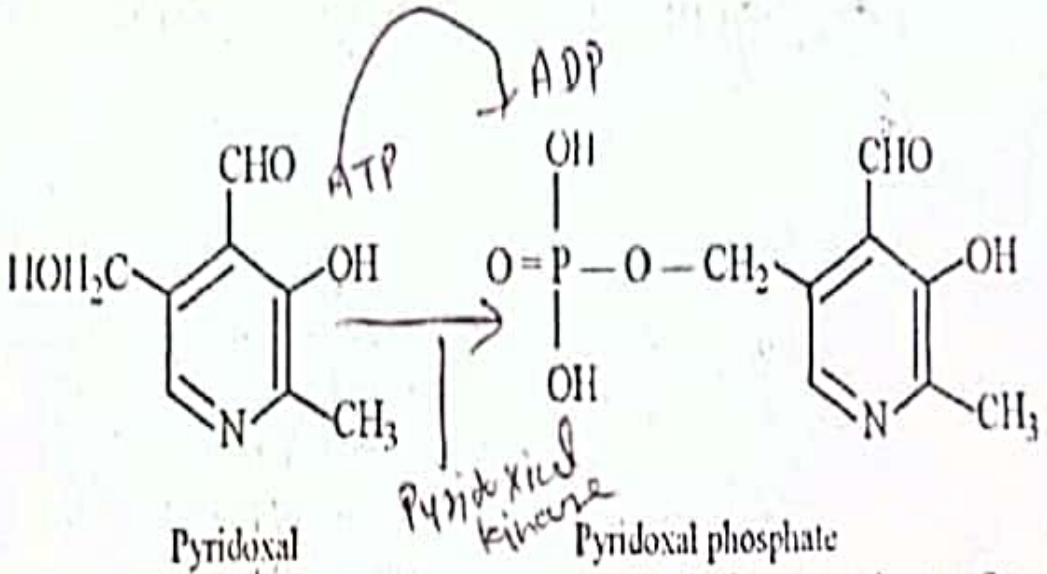
(III) Pyridoxal phosphate [Codecarboxylase or Co-transaminase]

Pyridoxine (Vitamin B_6) is important part of human diet. Co-enzyme pyridoxal phosphate is obtained by the phosphorylation of pyridoxal (an aldehyde).

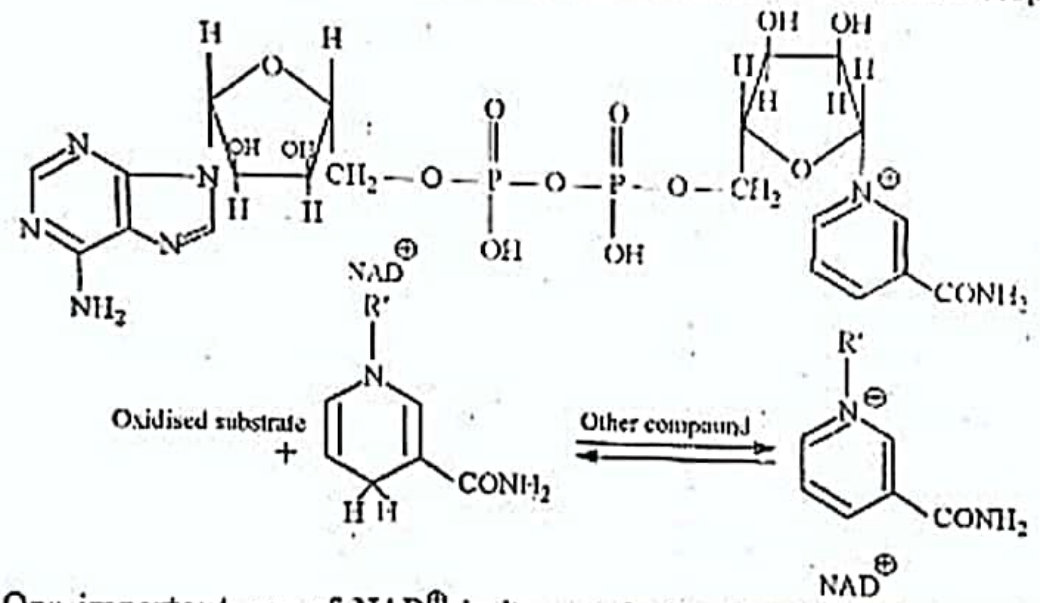


Pyridoxal — Pyridoxal phosphate

It is involved in a number of important metabolic reactions of α-amino acids, *e.g.*, transamination, racemization, decarboxylation and elimination reactions *etc.* Therefore, pyridoxal phosphate is one of the nature's most versatile co-enzymes. Chemistry of this co-enzyme involves proton transfer. Transamination is of central importance in the **nitrogen-metabolism** and it gets converted into pyridoxamine. A general example of transmination is given below :

(IV) $NAD^{\oplus}$ (B3 - Nicotinic acid) Niacin

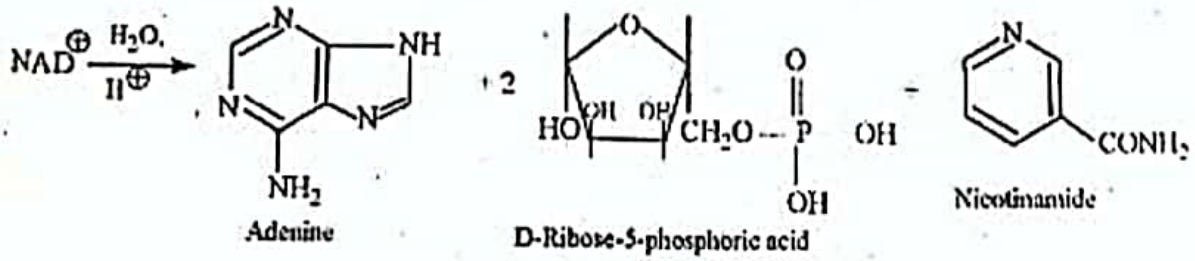
It is also known as DPN (diphosphopyridine nucleotide) or Codehydrogenase I or Coenzyme I or Cozymase. $NAD^{\oplus}$ stands for nicotinamide adenine dinucleotide. This is hydrogen transfer co-enzyme & its activity is due to nicotinamide. It accepts hydrogen from substrate (which is oxidised) and then transfer step by step to other compounds such as flavoprotein, cytochrome *b*, cytochrome *c*, cytochrome *a* and cytochrome oxidase. The last compound gives its hydrogen to oxygen, forming water. The overall result is oxidation of substrate. Transference of hydrogen is reversible and stereospecific.



One important use of $NAD^{\oplus}$ is its use during the alcoholic fermentation where CH_3CHO is reduced to C_2H_5OH by means of NADH.

Structural elucidation of $NAD^{\oplus}$: Structure of $NAD^{\oplus}$ has been revealed on the basis of hydrolysis under different conditions as given below :

(a) Acid Hydrolysis : Hydrolysis of one molecule of this coenzyme under acidic condition gives one molecule of adenine, two molecules of D-ribose-5-phosphoric acid and one molecule of nicotinamide.

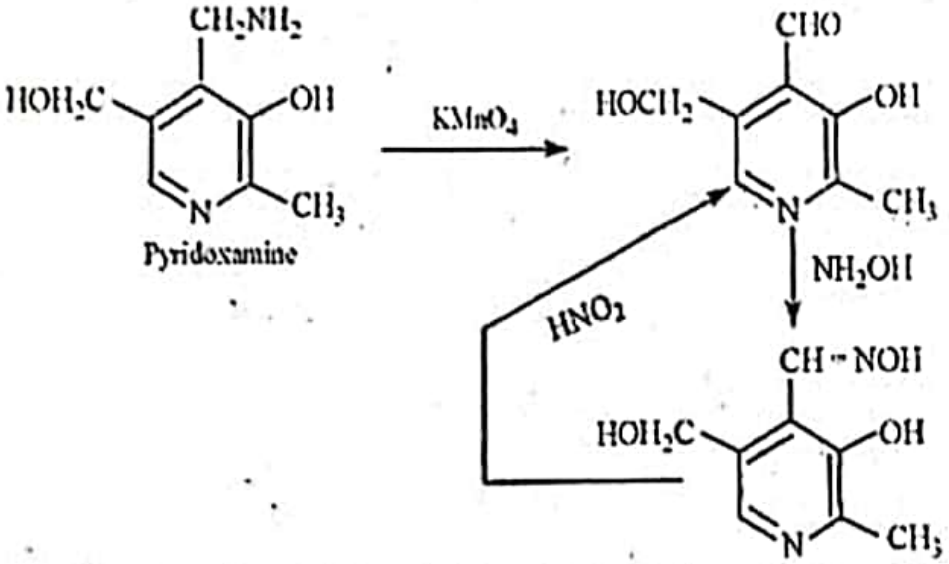


These results indicate that $NAD^{\oplus}$ contains one adenine, two ribose, two phosphoric acid and one nicotinamide molecules per molecule of $NAD^{\oplus}$.

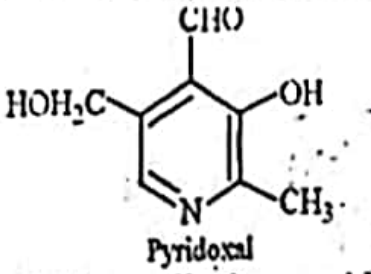
Structure and synthesis of pyridoxal phosphate :

Pyridoxal phosphate is obtained by the phosphorylation of pyridoxal. Therefore, if we synthesise pyridoxal and determine its structure, structure of pyridoxal phosphate can be determined :

Pyridoxal is obtained by the oxidation of pyridoxamine with potassium permanganete and it upon treatment with hydroxylamine gives oxime which can be reconverted to pyridoxal upon treatment with nitrous acid.



As clear with the above conversions, structure of pyridoxal is :



Pyridoxal upon phosphorylation will give pyridoxal phosphate which have following structure :