Shree H.N.Shukla Group of Colleges, Rajkot

M.sc Chemistry Semester-3

Subject: Chemistry of Natural product

Unit-1 Nucleic acid

Structure of Nucleotide

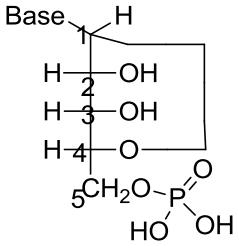
- Nucleotide are phosphoric acid ester obtain by control hydrolysis of nucleic acid
- On neutral hydrolysis of nucleotide it gives ribose monophosphate and base that means phosphate group is attached with sugar not with base
- For phosphoester bonding in sugar, three hydroxy group available in sugar at possition2',3' and 5'
- Tree possible nucleotide are shown in the below with structure

Base+Sugar+H3PO4= Nucleotide

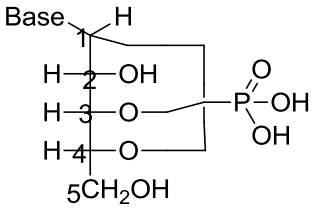
↓ carefully hydrolysis

Sugar Monophosphate (Sugar+H3PO4) + Only base

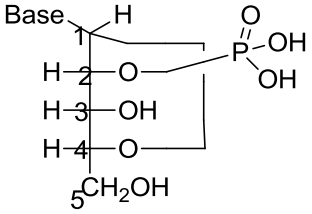
↓ since nucleotide is phosphate ester point of linkage is possible at hydroxy on 2,3 and 5 possition



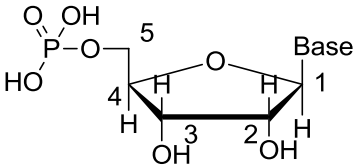
5' Nucleotide

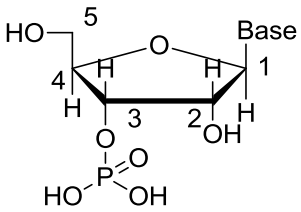


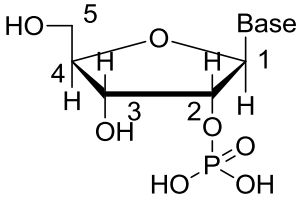
3'Nucleotide



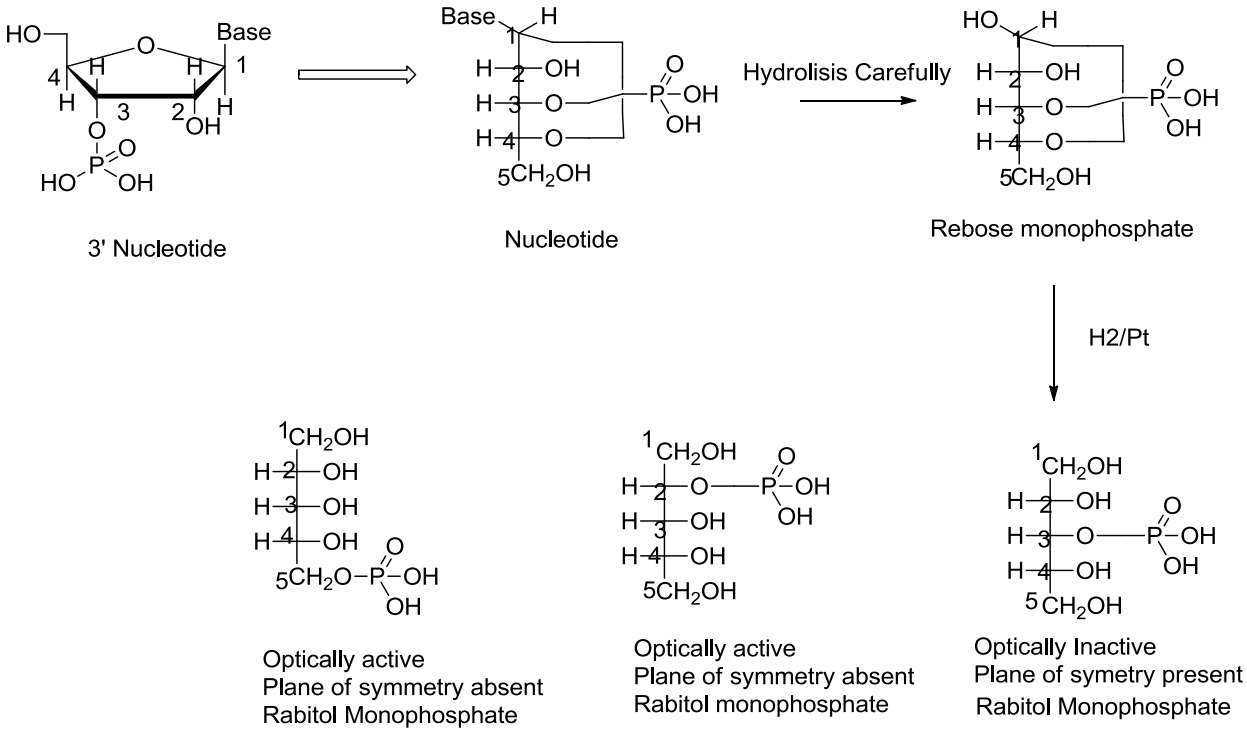
2' Nucleotide







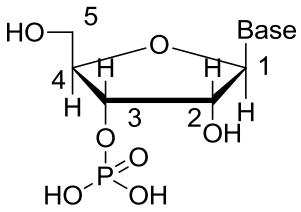
Proof In the favor of position 3' as the point of linkage



- Ribose monophosphate on catalytic hydrogenation gives rabitol phosphate which is optically inactive
- This product can optically inactive only when the phosphate group is attached at the position 3'
- If the phosphate group is attached at the position 2' and 3' then it gives optically active rabitol monophosphate
- Hence on the above evidence phosphate group is attached at the position 3'

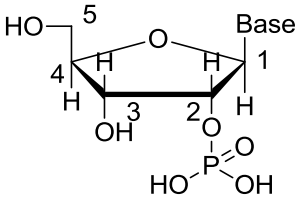
Proof In the favor of position 2' and 3' as the point of linkage

- For long time it is consider that phosphate group is attach at the position 3'
- But Complication arise in the observation of Cohn and Corter
- RNA ⟶ Mixture Of two compounds a and b on alkaline hydrolysis
- i.e adrenalic acid a and adrenalic acid b
- i.e guanylic acid a and guanylic acid b
- loring showed that two acids a' and b' are 2' phosphate nucleotide and 3' phosphate nucleotide
- bcos both acid are not affected by HIO4



3' Phosphate Nucleotide

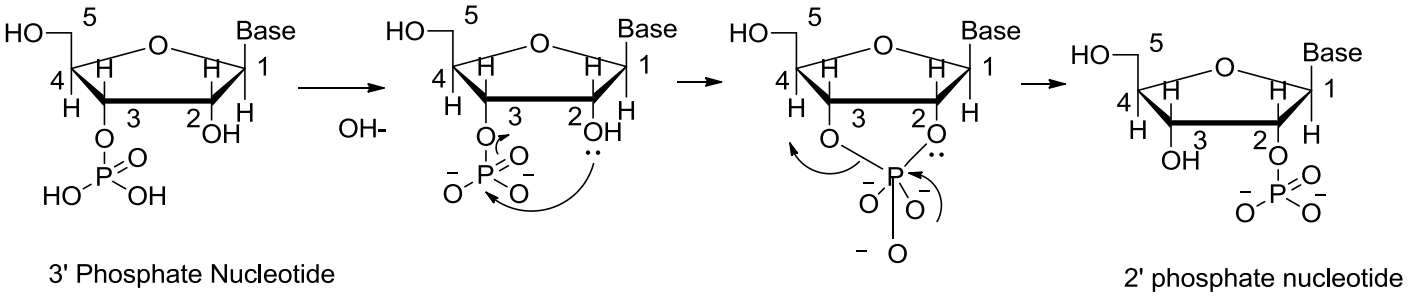
'b'



2' phosphate nucleotide

'a'

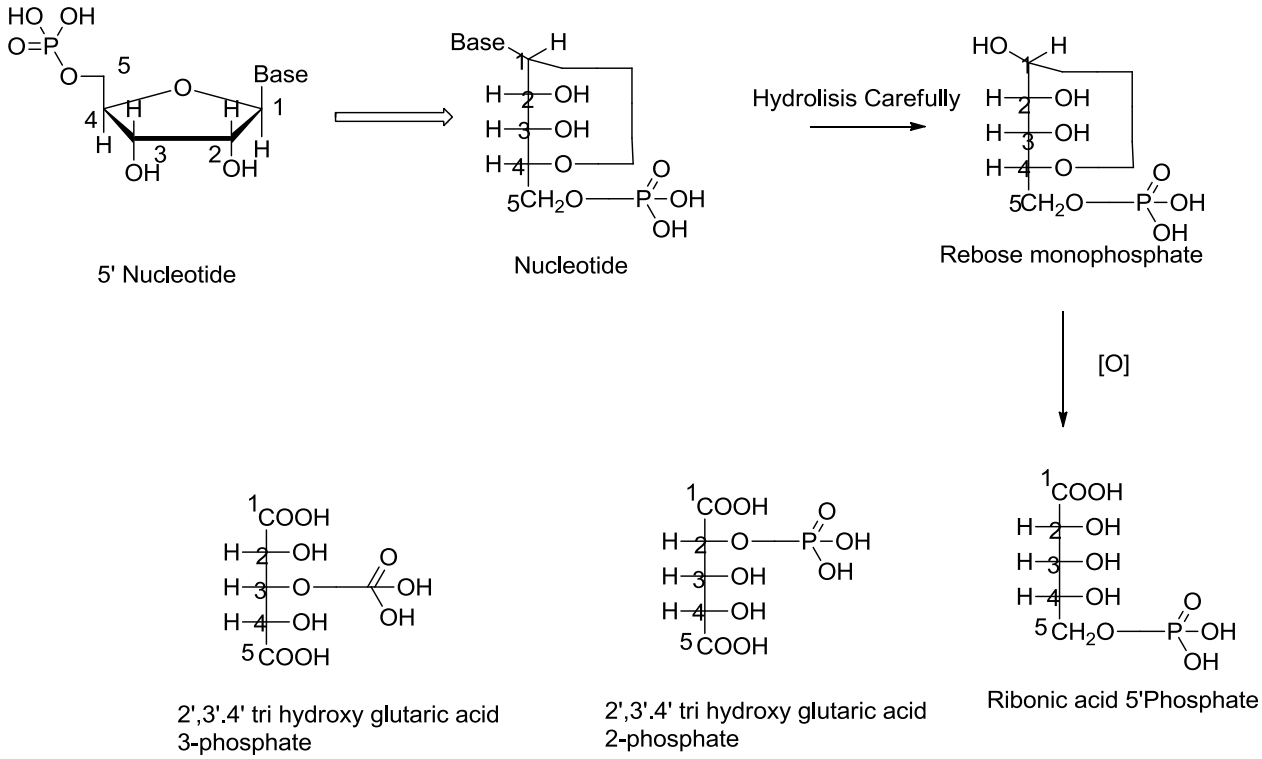
- Reson for the formation of Two compounds is the easy phosphorylmigration between position 2 and 3 in the nucleotide via the formation of cyclic intermediate 2' 3' cyclic phosphate
- Hence on the above evidence phosphate group is attached at the position 2' and 3'



3' Phosphate Nucleotide

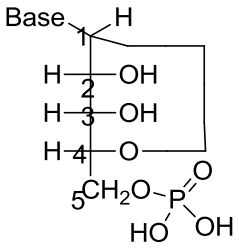
2' phosphate nucleotide

Proof In the fevour of 5' as the point of linkage

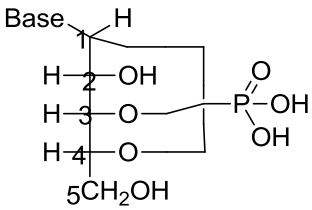


The position of Phosphate group in nucleotide is also be shown by the action of HIO4

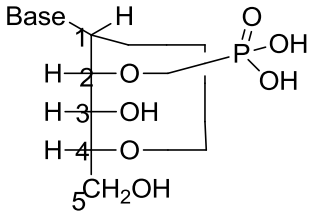
- Nucleotide having the phosphate group at the position 5' has two adjacent hydroxyl group so affected by HIO4 while.
- Nucleotide having 2' and 3' Phosphate group have not two adjacent hydroxyl group so cannot be affected by HIO4



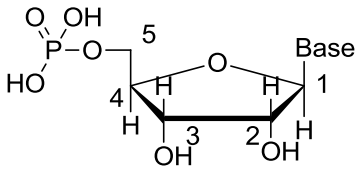
5' Nucleotide

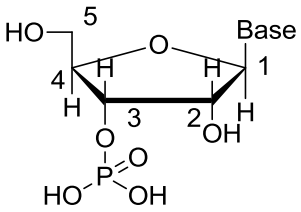


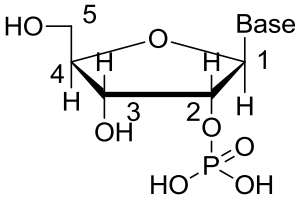
3'Nucleotide



2' Nucleotide



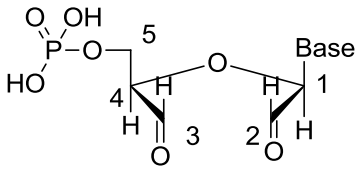




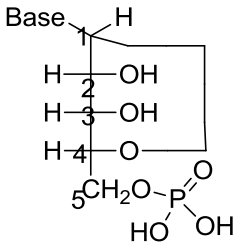
HIO4

HIO4

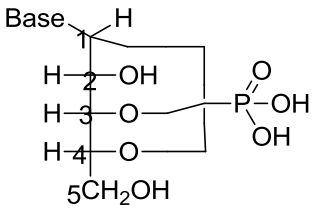
HIO4



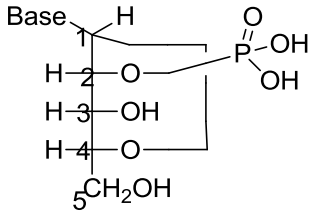
- Thus on the basis of above evidence phosphate group occupy the position 2', 3' and 5' in the ribose nucleotide and 3' and 5' in the deoxyribonucleotide
- The final proof for the structure of Nucleotide furnished by its synthesis
- So on the above discussion structure of Nucleotide can be written as below



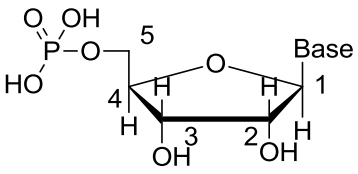
5' Nucleotide

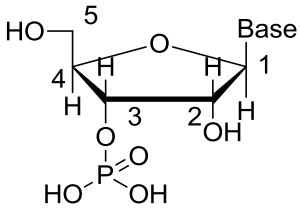


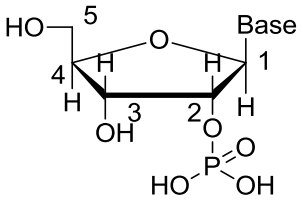
3'Nucleotide



2' Nucleotide







Structure of Nucleic acid (arrangement of Nucleotide)