

## Nucleic Acids

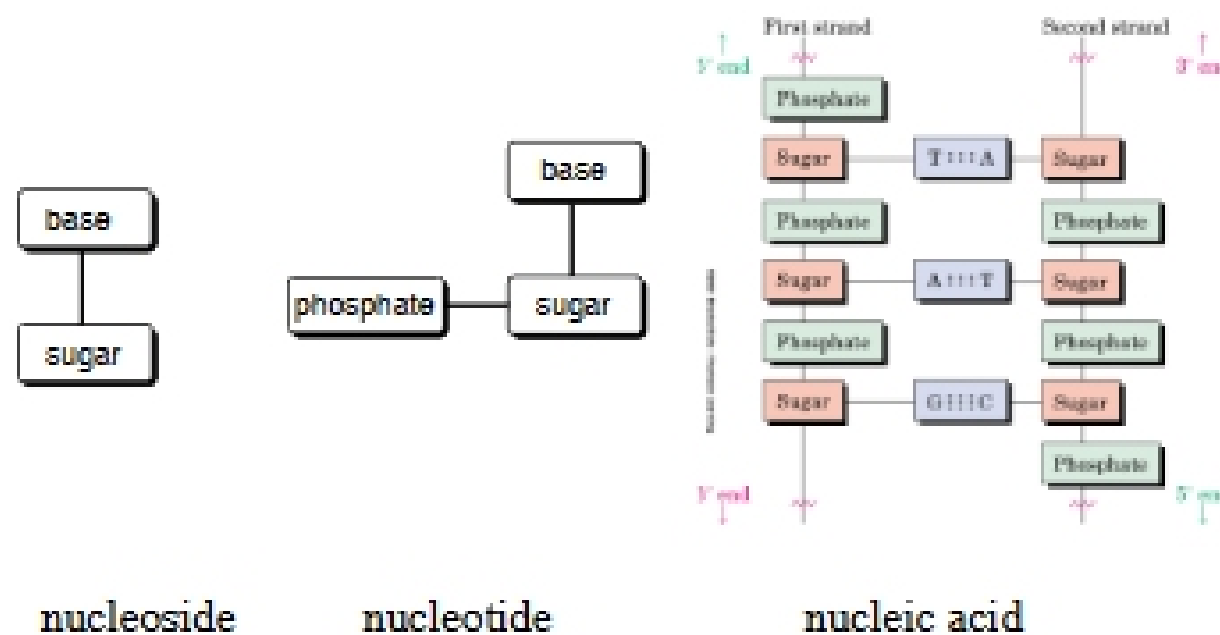
- 1869: Miescher- gelatinous material from cell nuclei of white blood cells containing organophosphorous compounds- nuclein (chromatin)- discovery of nucleic acids
- 1891: Kossel- identified the DNA bases A, T, G and C  
identified D-ribose in nucleic acids
- 1889: Altman- purified DNA
- 1901: Ascoli- identified U in RNA
- 1910: DNA and RNA realized to be separate entities. DNA (thymus) RNA (yeast)
- 1929: Levene & Jacobs- identified 2'-deoxyribose in DNA
- 1920's - 1950's: structures of nucleosides and nucleotides. Alexander Todd (Nobel Prize, 1959)
- 1928: Griffith- first to propose that DNA was genetic material; not widely accepted
- 1931: Levine & Bass- first proposed structure. Believed to be part of chromosome physiology, but NOT genetic material
- 1944: Avery, MacLeod & McCarty- Strong evidence that DNA is genetic material
- 1950: Chargaff- careful analysis of DNA from a wide variety of organisms. Content of A,T, C & G varied widely according to the organism, however: **A=T and C=G (Chargaff Rule)**
- 1953: Watson & Crick- structure of DNA (Nobel Prize with M. Wilkens, 1962)



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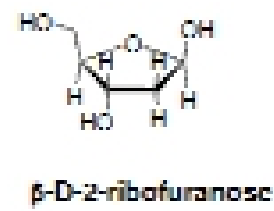
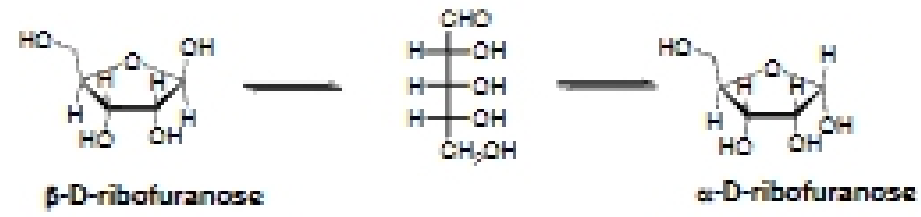
## Nucleoside, nucleotides and nucleic acids

Blackburn *et al.* Ch. 2



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## Sugar: D-ribose



### Stereochemistry:

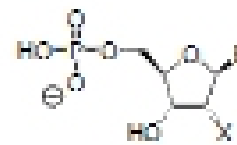
As drawn, the side above the plane of the ring is  $\beta$   
the side below the plane of the ring is  $\alpha$

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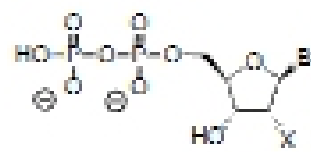
## Nucleosides vs Nucleotides



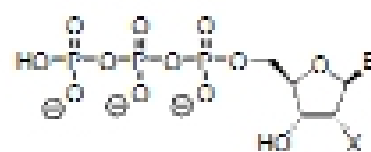
ribonucleoside (X-OH)  
deoxyribonucleoside (X-H)



ribonucleotide (X-OH)  
deoxyribonucleotide (X-H)



nucleosidediphosphate

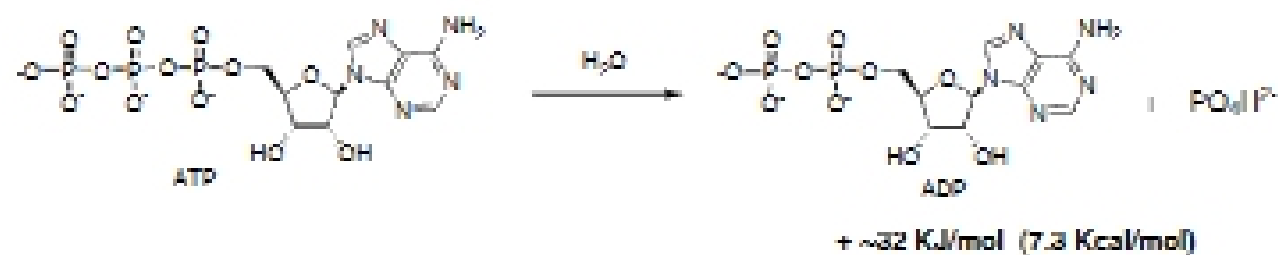


nucleosidetriphosphate



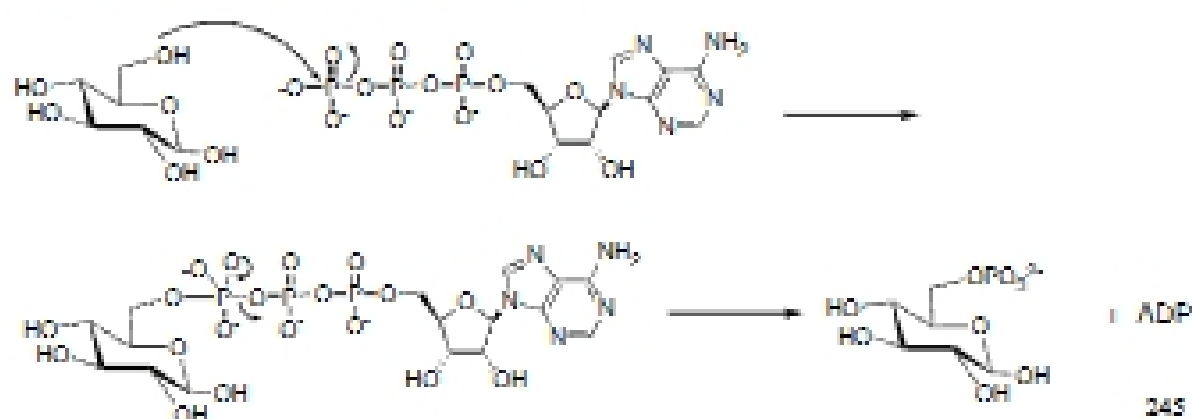
3',5'-cyclic phosphate

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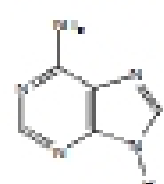
Hydrolysis of ATP is used to drive many biochemical reactions

Phosphoryl transfer reactions:

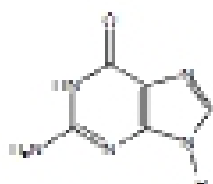


## Bases

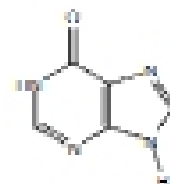
### A. Purines



Adenine (A)  
Adenosine (A-ribose), Adenine (A-deoxyribose)

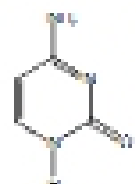


Guanine (G)  
Guanosine (G-ribose), Guanosine (G-deoxyribose)

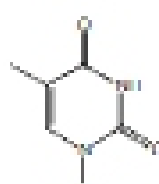


Hypoxanthine (H)  
Inosine (H-ribose), Inosine (H-deoxyribose)

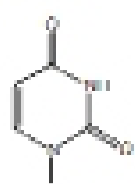
### B. Pyrimidines



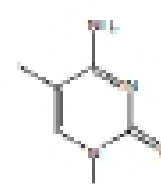
Cytosine (C)  
Cytidine (C-ribose), Cytidine (C-deoxyribose)



Uracil (U)  
Uridine (U-ribose), Uridine (U-deoxyribose)



Thymine (T)  
Thymidine (T-ribose), Thymidine (T-deoxyribose)



Uridine (U)  
Uridine (U-ribose), Uridine (U-deoxyribose)

DNA contains A, C, G, T all with 2'-deoxyribose  
RNA contains A, C, G, U all with ribose

The stereochemistry of the base is β

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