

DNA and RNA

part one: Nucleotides

Assist. Prof. Dr. Usama H. Ramadhan



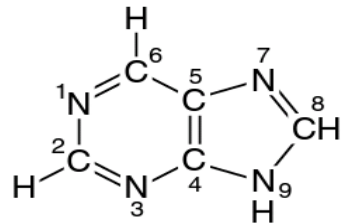
BIOMEDICAL IMPORTANCE

Nucleotides the monomer units or building blocks of nucleic acids serve multiple additional functions.

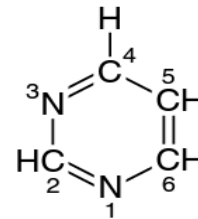
They form a part of many coenzymes and serve as donors of phosphoryl groups (eg, ATP or GTP), of sugars (eg, UDP- or GDP-sugars), or of lipid (eg, CDP-acylglycerol).

Regulatory nucleotides include the second messengers cAMP and cGMP, the control by ADP of oxidative phosphorylation, and allosteric regulation of enzyme activity by ATP, AMP, and CTP.

Synthetic purine and pyrimidine analogs that contain halogens, thiols, or additional nitrogen are employed for chemotherapy of cancer and AIDS and as suppressors of the immune response during organ transplantation



Purine

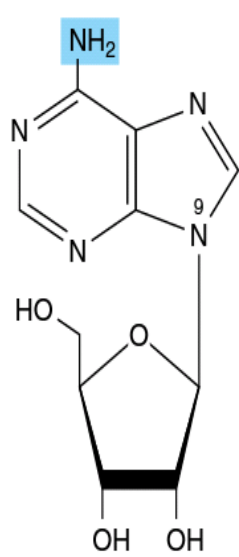


Pyrimidine

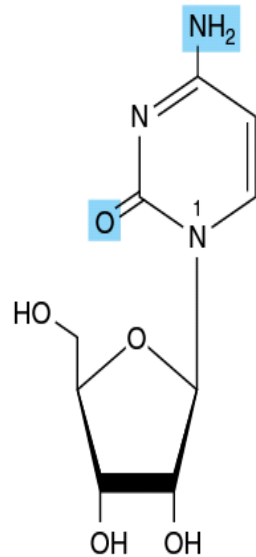
Figure 33–1. Purine and pyrimidine. The atoms are numbered according to the international system.



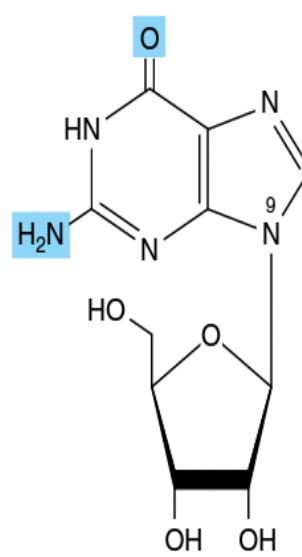
Nucleotides



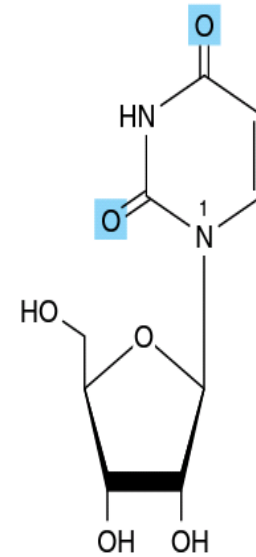
Adenosine



Cytidine

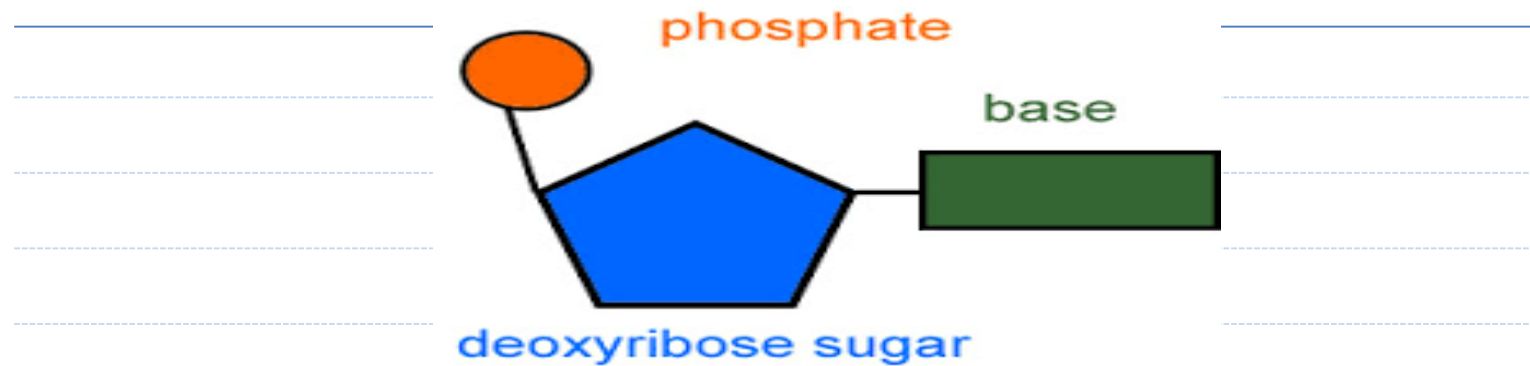


Guanosine



Uridine

Figure 33-3. Ribonucleosides, drawn as the syn conformers.



The ATP

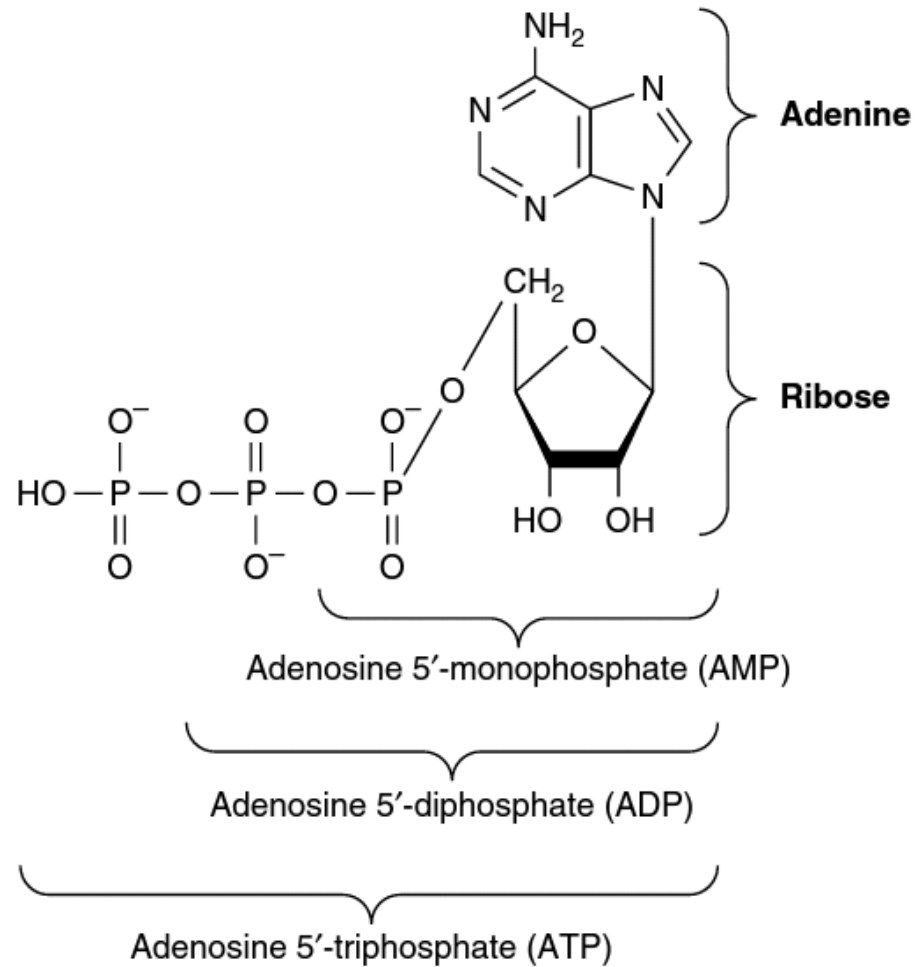
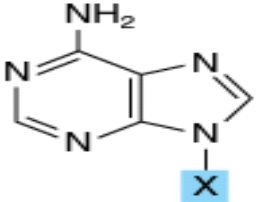
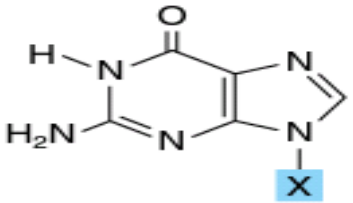
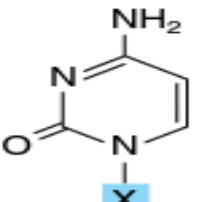
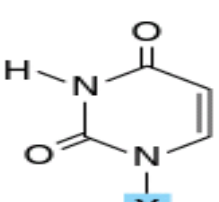
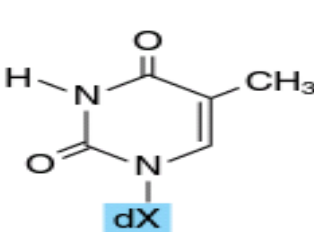


Figure 33-4. ATP, its diphosphate, and its monophosphate.

Base Formula	Base X = H	Nucleoside X = Ribose or Deoxyribose	Nucleotide, Where X = Ribose Phosphate
	Adenine A	Adenosine A	Adenosine monophosphate AMP
	Guanine G	Guanosine G	Guanosine monophosphate GMP
	Cytosine C	Cytidine C	Cytidine monophosphate CMP
	Uracil U	Uridine U	Uridine monophosphate UMP
	Thymine T	Thymidine T	Thymidine monophosphate TMP

Deoxy ribose Nucleotides

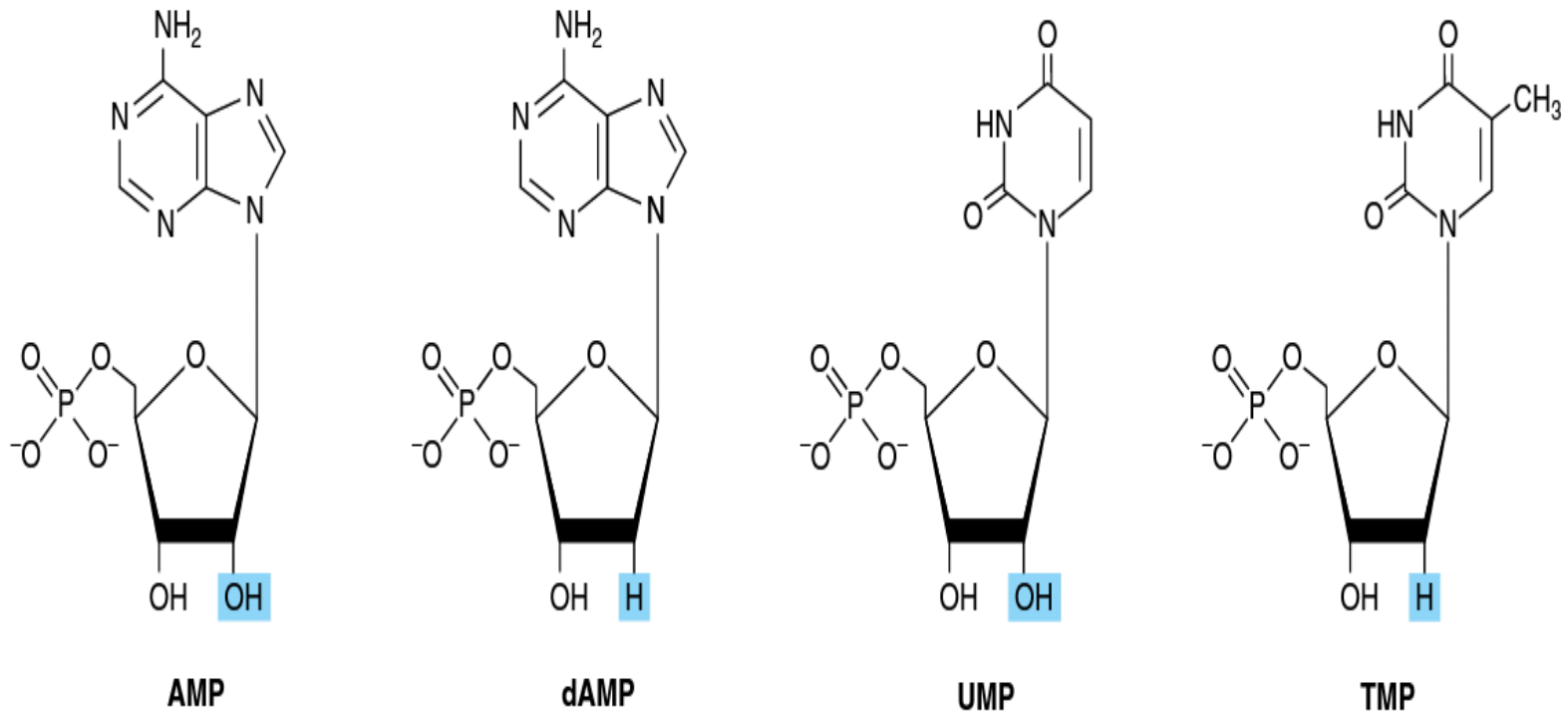


Figure 33-6. AMP, dAMP, UMP, and TMP.

Pyrimidine and purine bases analog used as drugs

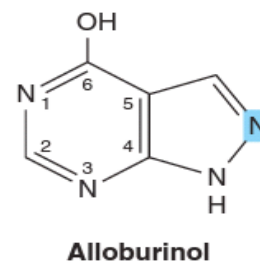
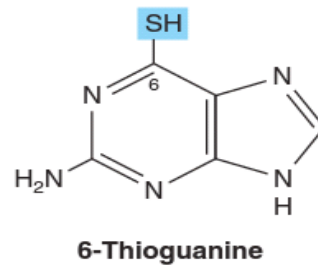
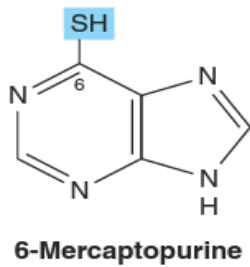
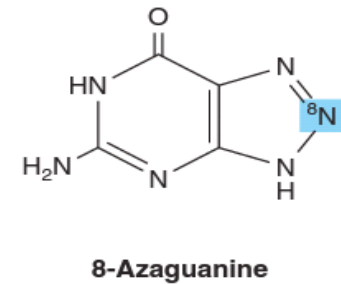
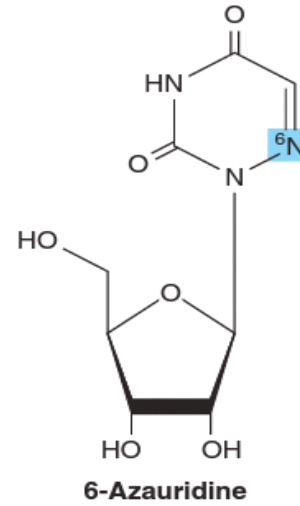
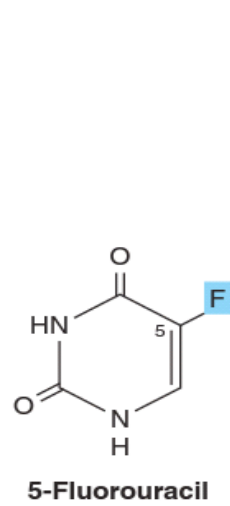
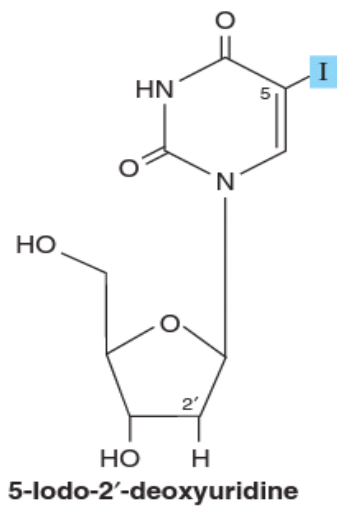
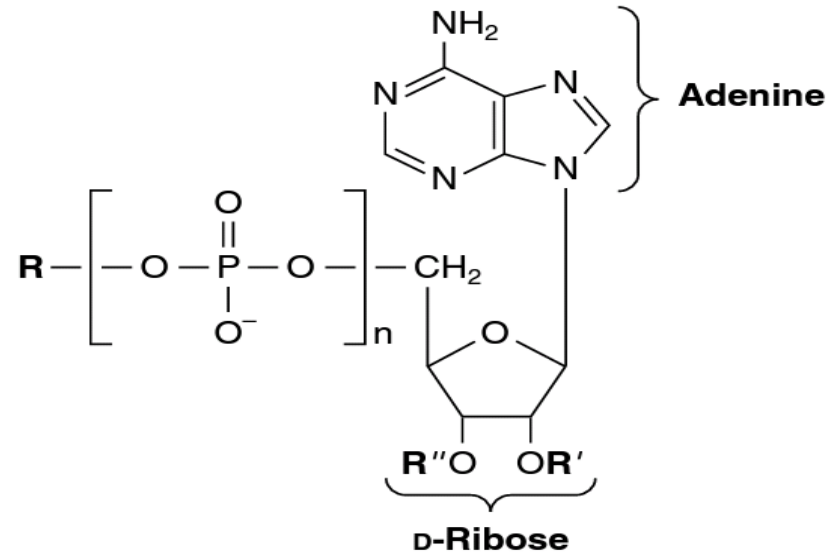


Figure 33-12. Selected synthetic pyrimidine and purine analogs.

Coenzymes



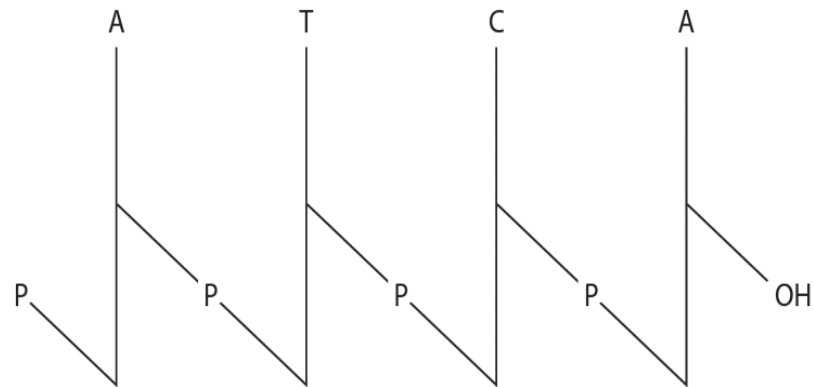
Table 33–2. Many coenzymes and related compounds are derivatives of adenosine monophosphate.



Coenzyme	R	R'	R''	n
Active methionine	Methionine*	H	H	0
Amino acid adenylates	Amino acid	H	H	1
Active sulfate	SO ₃ ²⁻	H	PO ₃ ²⁻	1
3',5'-Cyclic AMP		H	PO ₃ ²⁻	1
NAD*	†	H	H	2
NADP*	†	PO ₃ ²⁻	H	2
FAD	†	H	H	2
CoASH	†	H	PO ₃ ²⁻	2

*Replaces phosphoryl group.

†R is a B vitamin derivative.

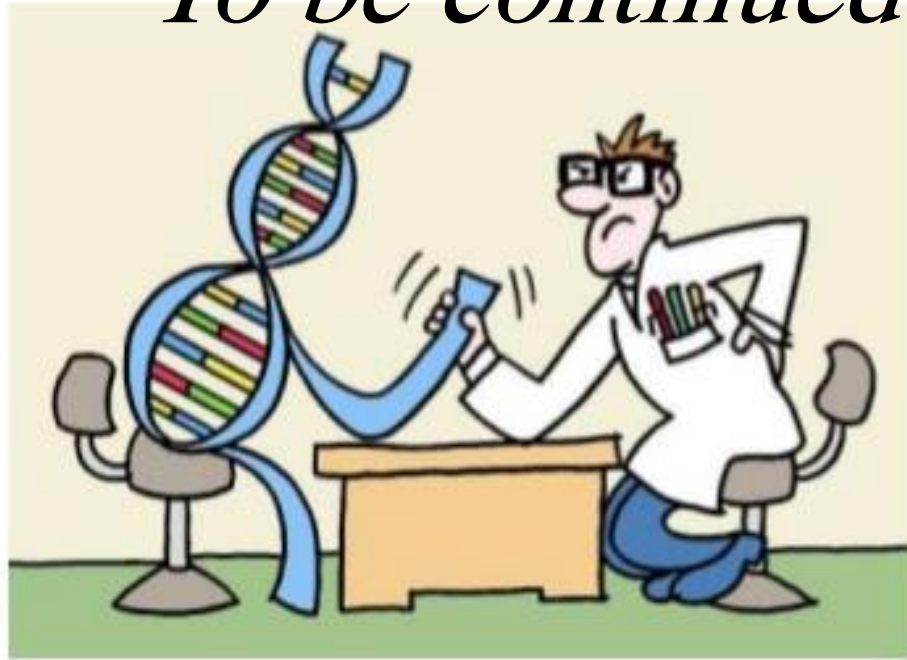


pGpGpApTpCpA

GGATCA

This information, detailing the specific structure of the proteins inside of our bodies, is stored in a set of molecules called nucleic acids.

To be continued



Any questions