Module 9 / Bases

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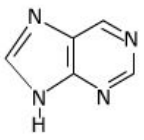
Identify the difference between a purine and pyrimidine.	Identify the structure of each of the nitrogenous bases: A, T, G, C,U.	Describe the difference and identify the difference between a nucleotide and a nuceloside.
Correctly identify and specifically name all of the nucleotides.	Identify which bases are incorporated into DNA and RNA.	

The Bases

The backbone structure of both DNA and RNA shows variability according to the composition of X in the structure given on the previous page. X represents a set of nitrogenous bases. The bases are divided into two fundamental ring structures: purines (2 fused aromatic rings) and pyrimidines (a single aromatic ring). The differences in the bases, which are only found attached to a sugar, give rise to the second major variation in the difference between DNA and RNA.

All of the bases have the common structural characteristic that they are **planar structures** due to the aromatic (alternating double bonds in the rings) structure of the molecules. This feature parallels that previously seen with the phenyl group [Refer to the Functional Groups simulation in the Glossary to review the structure of the phenyl group]. This aromatic character also gives rise to the ability of the bases to absorb ultraviolet light at 260 nm. This latter feature provides a distinctive means for identifying the presence of DNA and RNA molecules.

Purine	Pyrimidine
	
2 fused, planar rings	one, planar ring

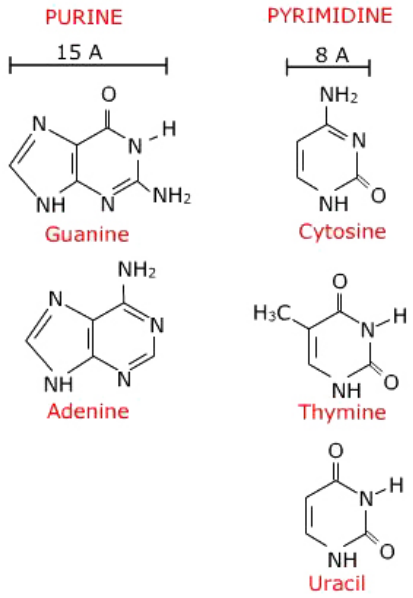
The variations in the structures of the purine and pyrimidine bases are limited to the five that are used during copying of DNA (Replication) or transcribing of DNA into RNA (Transcription). The structures of these nitrogenous bases are given below.

The bases do not occur as free bases in nature but are always bound to a furanose ring. Since the bases are always associated with a sugar in nature, they take on specific names according to their structure. The base

by itself has a specific name and the base attached to a sugar (a nucleoside) has a distinct name. The

by itself has a specific name and the base attached to a sugar (a nucleoside) has a distinct name. The following table gives the names of the purines and pyrimidines as the free base and as the nucleoside with their one letter abbreviation. The naming of the ***nucleotides*** is analogous to the ***nucleoside*** with the added specification of the location of the phosphate group. An example of this nomeclature is given below the table with the structures.

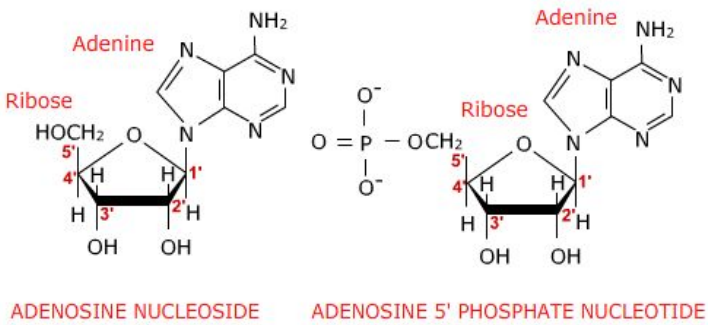
Structure of Bases



The Purine and Pyrimidine Bases

Purine Bases			**Pyrimidine Bases**		
base	**nucleoside**	**found in**	**base**	**nucleoside**	**found in**
Adenine	Adenosine (A)	DNA and RNA	Thymine	Thymidine (T)	DNA only
Guanine	Guanosine (G)	DNA and RNA	Uracil	Uridine (U)	RNA only
.			Cytosine	Cytidine (C)	DNA and RNA

Nucleoside vs Nucleotide



A nucleoside contains only a base attached to a sugar while a nucleotide is composed of a nucleoside to which a phosphate has been added at either the 3' or 5' position.

Linking the nucleotides together, a linear polymer is generated with sequences varying according to the

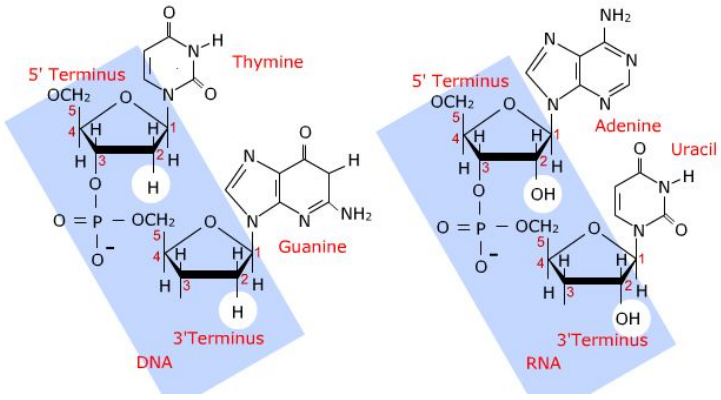
Linking the nucleotides together, a linear polymer is generated with sequences varying according to the placement of the bases along the final backbone. The following figure shows a tetranucleotide sequence of DNA. The bases, sugars and phosphodiester bonds are alternately highlighted. In the lower left of the frame is a schematic representation of the same sequence.

Flash Player needed! Please click here to install Flash Player.

The Phosphodiester Bonds between the sugars form the backbone structures of the DNA and RNA

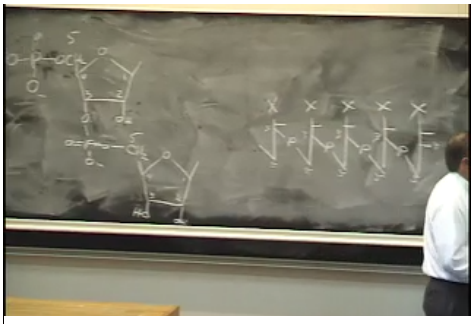
The illustration below shows a dinucleotide of DNA and RNA. Note the backbone to which each of the bases is attached. While there are four bases associated with DNA and four with RNA, are they the same set in each case?

Dinucleotides of DNA and RNA



Replacing the X's on the Backbone of DNA and RNA

The following link is a video in which Dr. Brown explains the structure of bases.



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