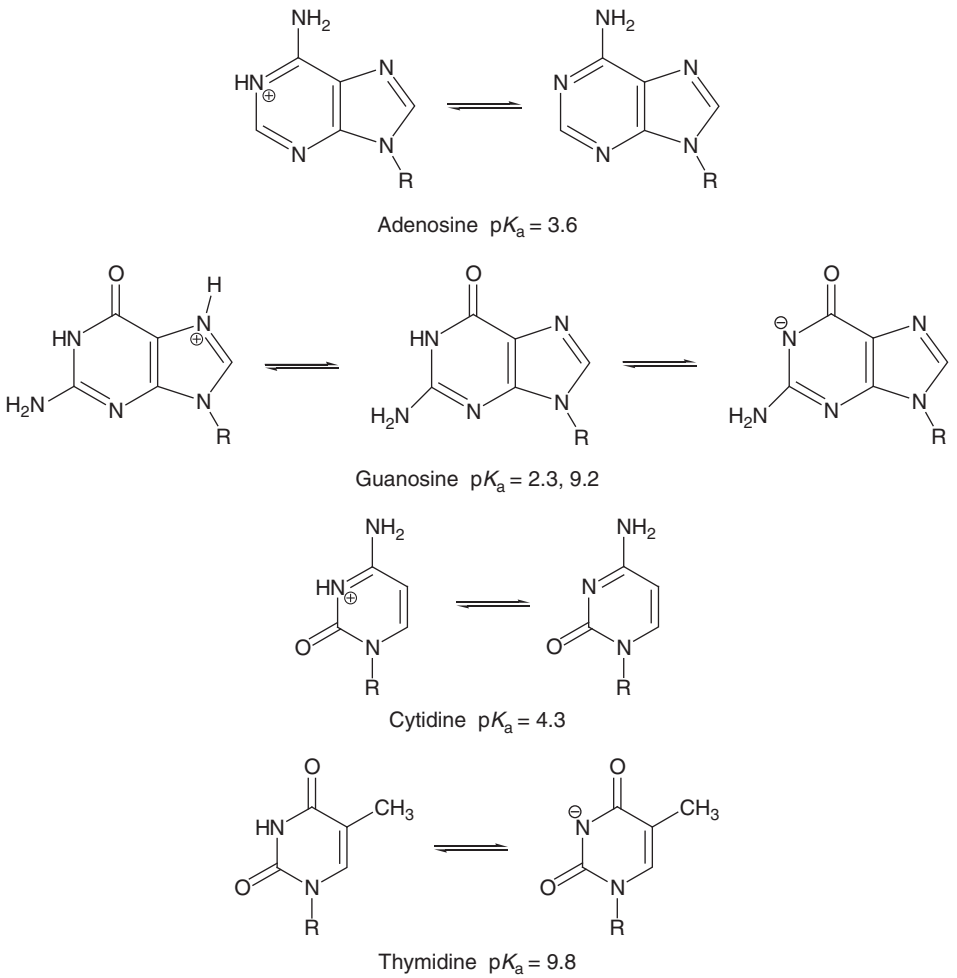

Figure 4-4 Titration sites and pK_a values for nucleosides.

of these is that proposed by James Watson and Francis Crick, resulting from their discovery of the DNA double helix, in which adenine pairs with thymine, and guanine pairs with cytosine. The keto tautomers of purines and pyrimidines form the base-to-base hydrogen bonds that are important for Watson–Crick base pairing. This type of base pairing is highly important for the association of polymerized strands of nucleic acid. Interestingly, however, in an aqueous solution of free single nucleotides there is very little Watson–Crick pairing; instead, the bases associate by stacking and by alternative hydrogen-bonding patterns.

Uracil and the other pyrimidine bases are, by themselves, not very water soluble. Purine is itself fairly water soluble, but the derivatives adenine and guanine are much less so. Addition of a polar sugar moiety, and of ionic phosphoryl groups, significantly improves the aqueous solubility of both purines and pyrimidines.

Two pentose sugars are important here, *ribose* and *2-deoxyribose* (**Figure 4-7**). The latter lacks the hydroxy group of ribose at the C2 position. Covalent linkage of the sugar to pyrimidine bases is from the C1 carbon of the sugar to the N1 nitrogen of the pyrimidine base, a glycosidic link. For purines, the glycosidic link is from the C1 carbon to the N9 nitrogen of the purine. The combination of sugar and base is referred to as a *nucleoside*.

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