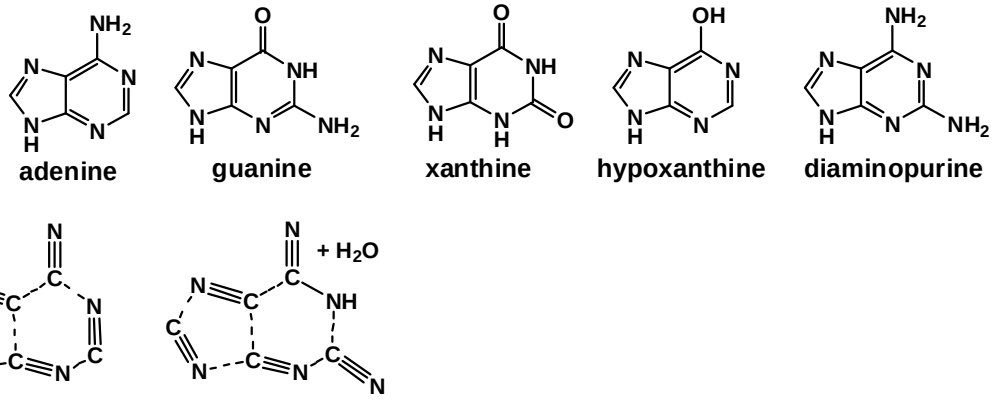
27-1. (a) Finish the reaction mechanism for the formation of α-uridine from Slide 27-9. Pay particular attention to the unaltered 2'-hydroxyl stereochemistry of ribose. You need not explicitly show proton transfers.

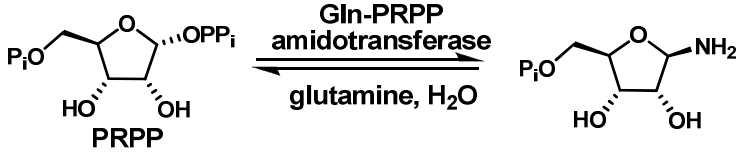
(b) Now show its hydrolysis to cytidine.

27-2. Drawn below adenine and guanine are diagrams that indicate the starting molecules used in their synthesis. 5 HCNs in adenine, 4 HCNs, cyanamide and water for guanine. Waters of hydration are ignored. Draw similar structures for the other three purines that are seen in cyanide polymerization reactions. What starting materials are necessary for their synthesis?



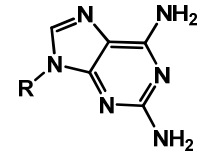
27-3. The reaction of urea and cyanoacetaldehyde produces pyridimidines. Hypothesize a pre-cellular synthesis of both urea and cyanoacetaldehyde starting from other simple compounds that have been mentioned over the last two lectures.

27.4. In modern cellular biosynthesis of nucleosides glutamine is used to amidate PRPP. Propose a mechanism for this transformation. You need not explicitly show proton transfers.

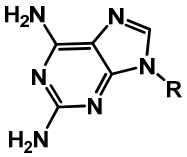


27.5 Imagine a hypothetical "Purine World" containing the five purines below.

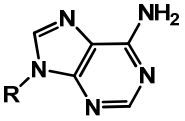
(a) Identify four Watson-Crick base pair partners with at least two hydrogen bonds each? Hint: The R groups should be on the same side of the rings, review diagrams from Lecture 22 to prove this to yourself.



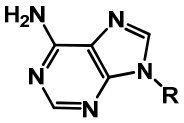
diaminopurine



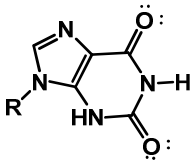
diaminopurine



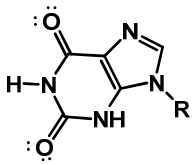
adenine



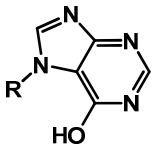
adenine



xanthine

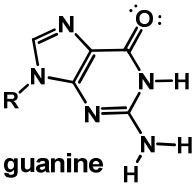


xanthine

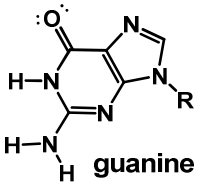


hypoxanthine

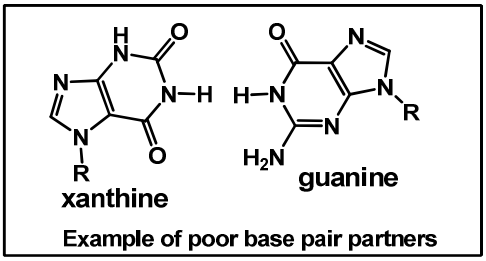
hypoxanthine



guanine



guanine



(b) Are there two base pair sets that would be non-promiscuous with each other (that is to say each base only base pairs with one partner)?

(c) Based on your answer to (b) hypothesize why pyrimidines exist.