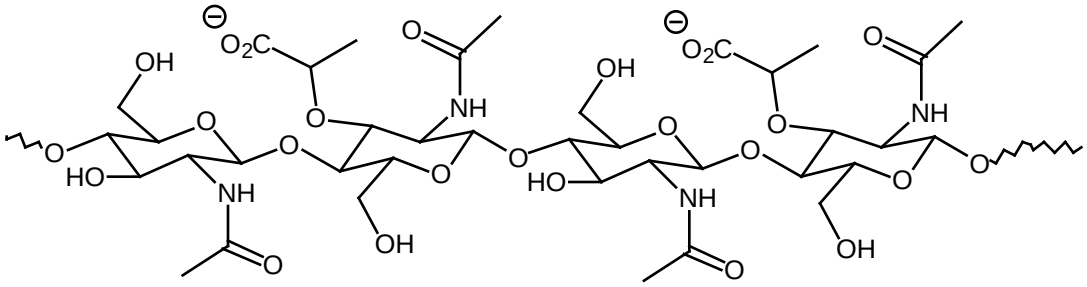
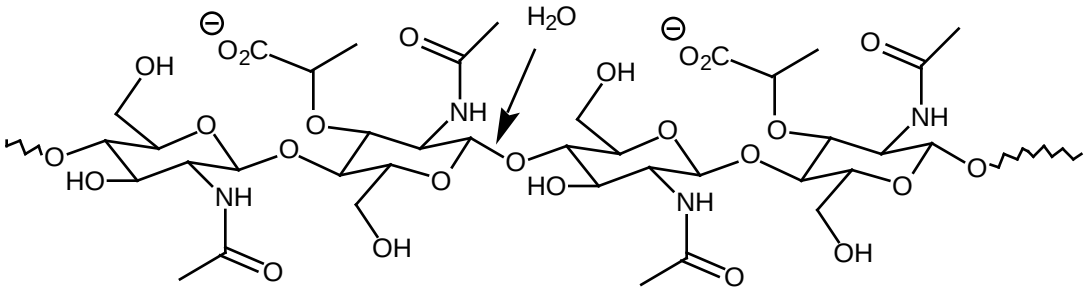
Chemistry 304B, Spring 1999 Lecture 34

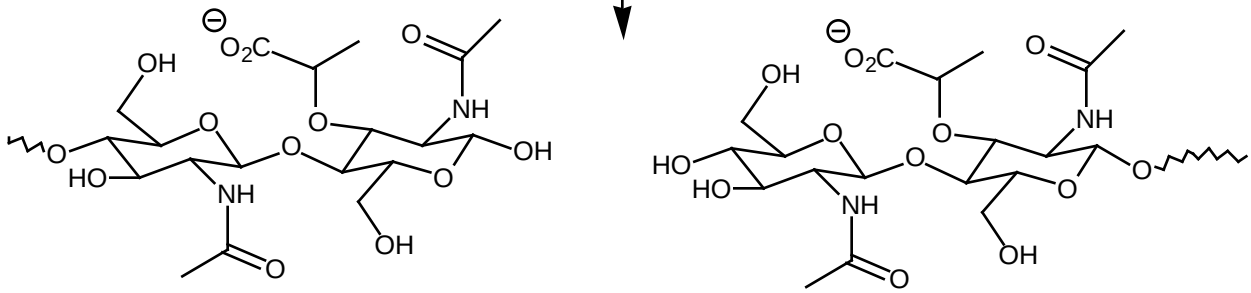
Review sessions: Monday evening, 8 pm RM 324 FRICK
Wednesday evening, 8 pm RM 324 FRICK
Exam: Thursday: 7:30 pm

Bacterial cell walls: very different from animals--polysaccharide cross-linked with polypeptide

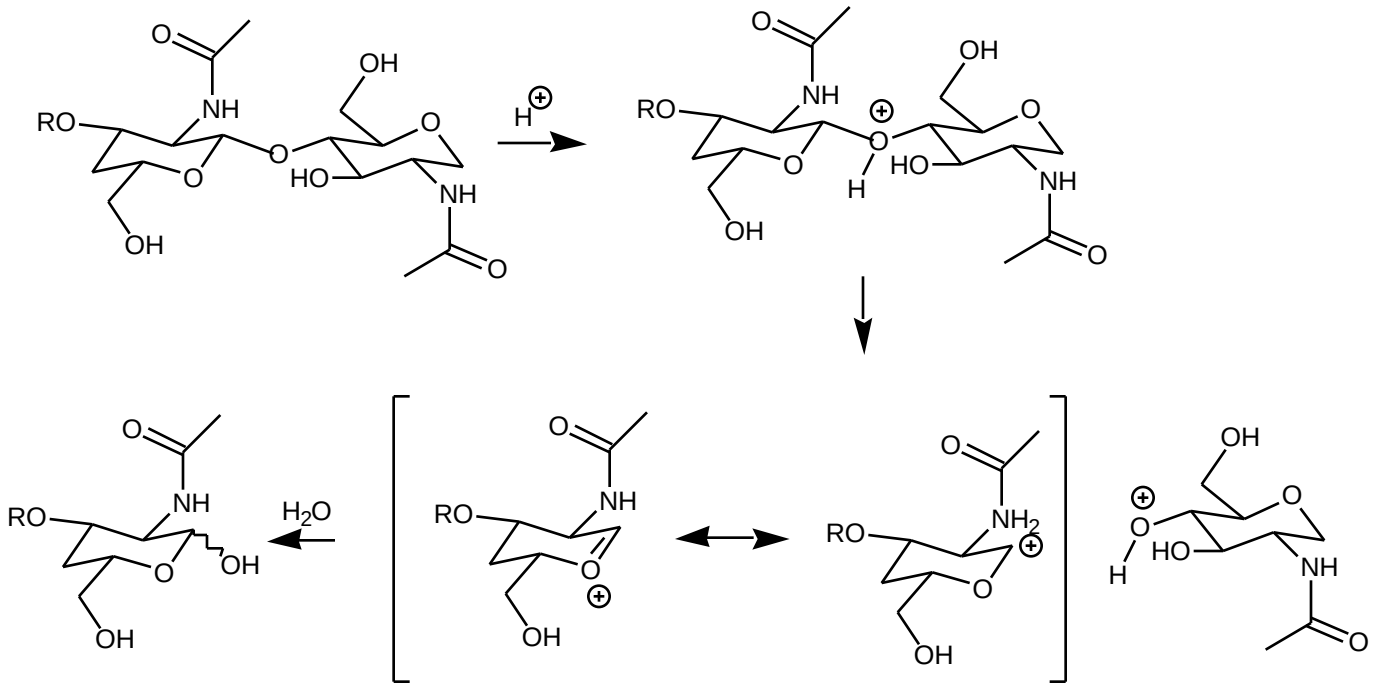


NAG NAM NAG NAM





Essential reaction:



An enzyme cleaves the bacterial cell wall: hen eggwhite **lysozyme** (1909)

129 AA **4 disulfide bonds** [handout on structure and mechanism]

Binds to a 6-unit section of the polysaccharide of the cell wall and hydrolyzes the acetal linkage

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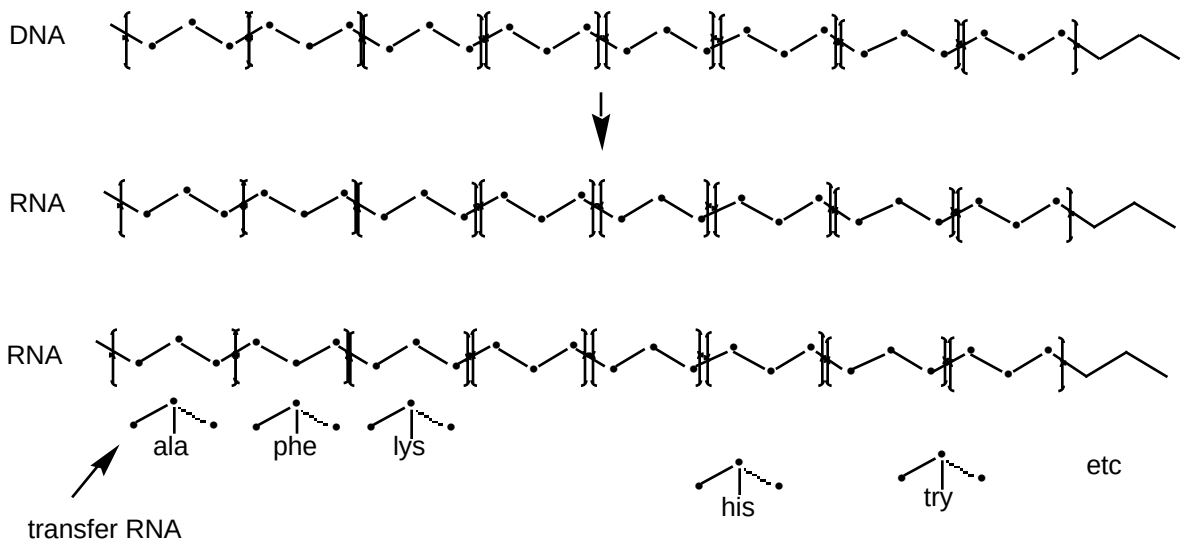
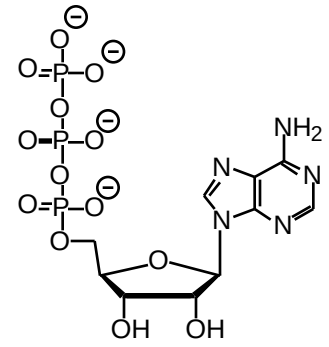
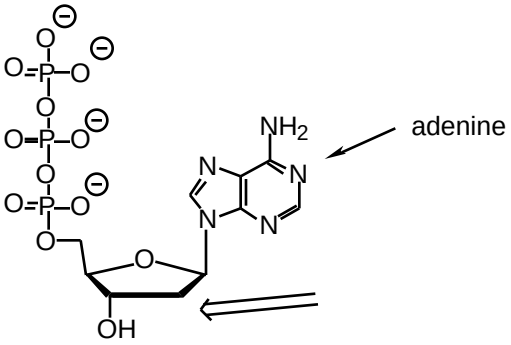
Nucleic Acids: Provide the code for polypeptide [protein] biosynthesis

1. simple, stable structure
2. able to be "read" by molecular association
3. translated to the selective formation of amide bonds in polymer formation

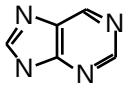




adenosine-5'-phosphate

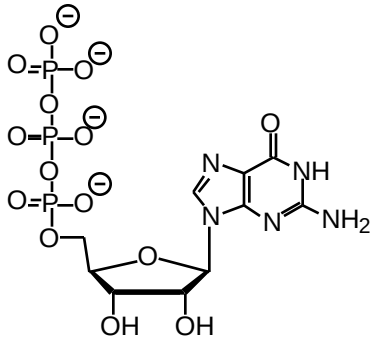


2'-deoxyadenosine-5'-phosphate

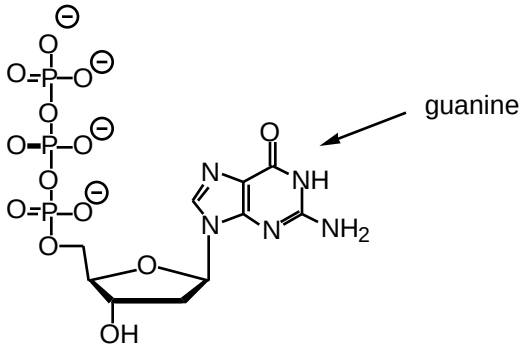


purine

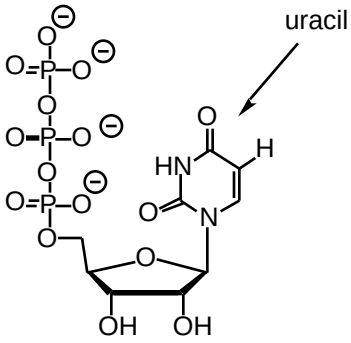
pyrimidine



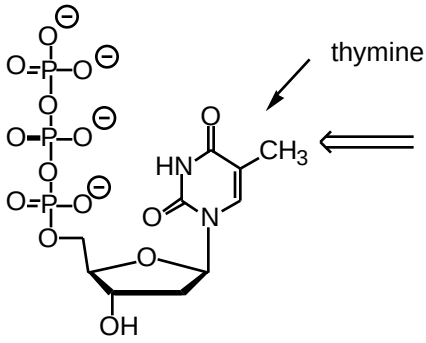
guanosine-5'-phosphate



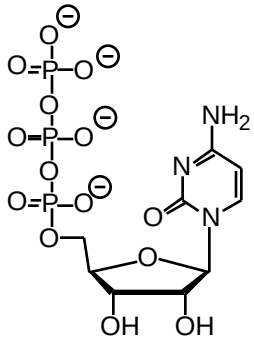
2'-deoxyguanosine-5'-phosphate



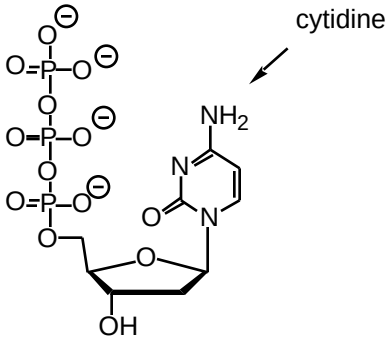
uridine-5'-phosphate



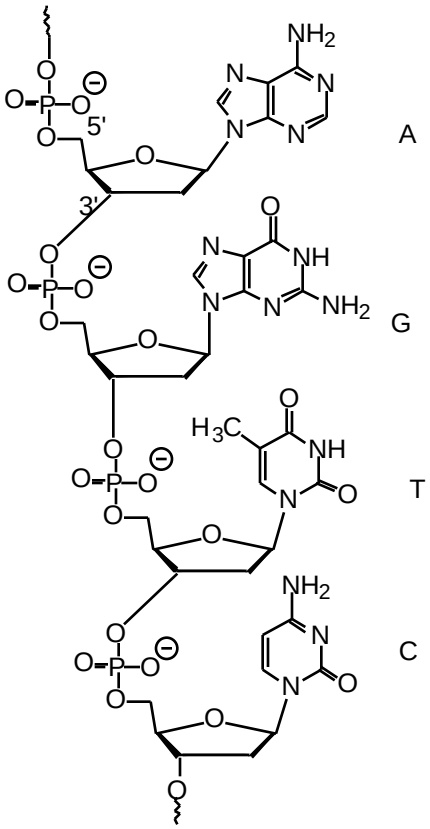
2'-deoxythymidine-5'-phosphate



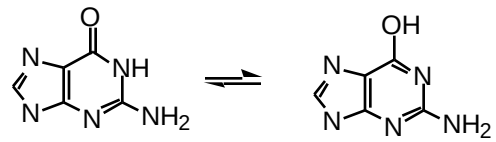
cytidine-5'-phosphate



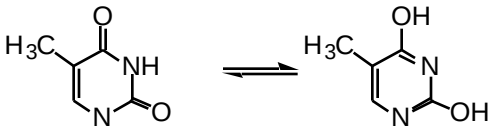
2'-deoxycytidine-5'-phosphate

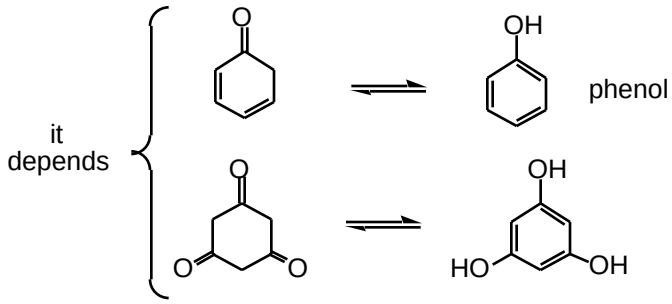


a piece of DNA

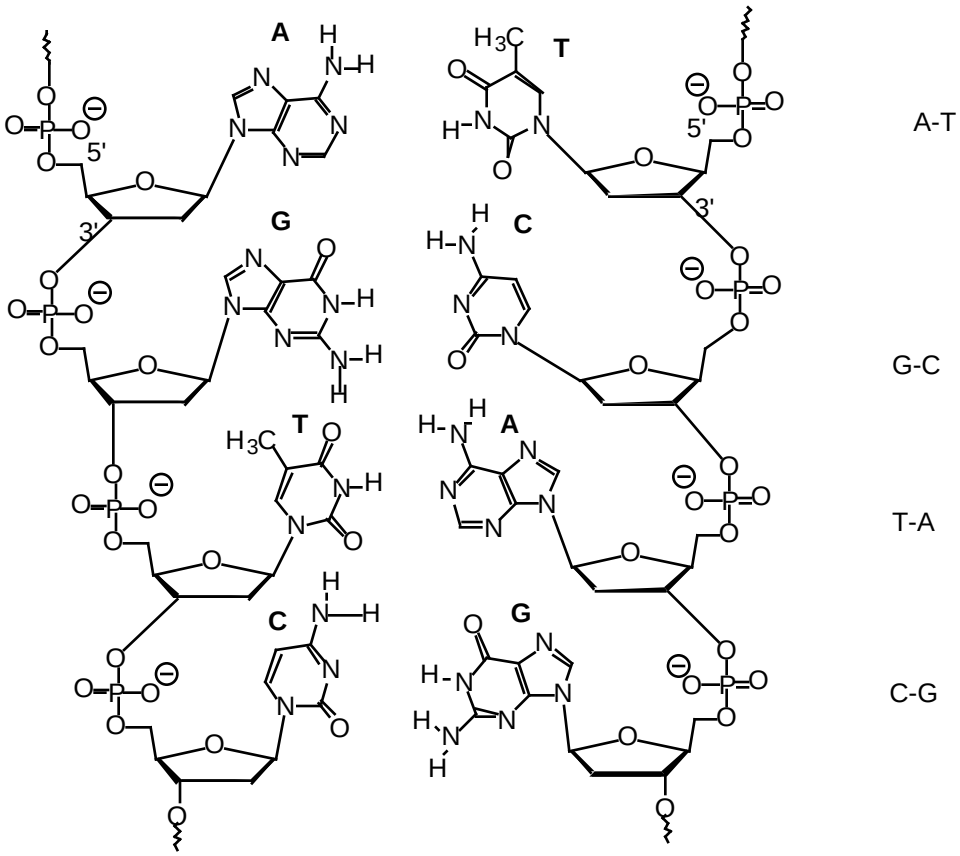


enol tautomer





balance C-H and C=O vs O-H, C=C, and aromaticity



A-T

G-C

T-A

C-G

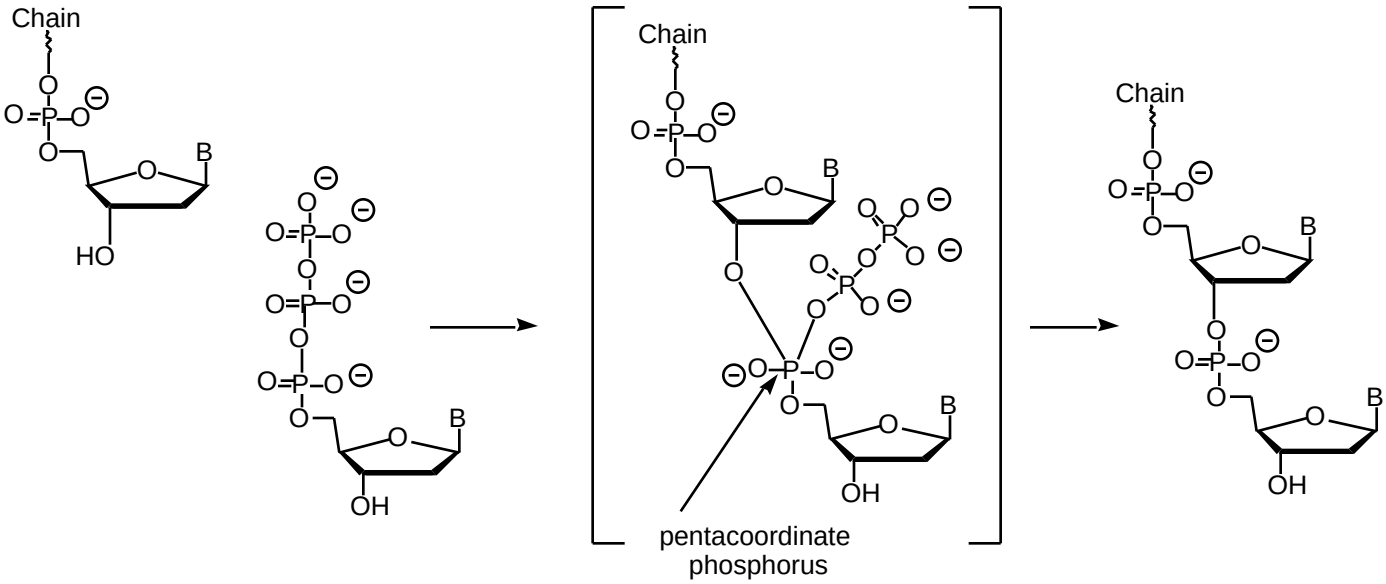
Verify for yourselves that other combinations do not work quite so well.

Biosynthesis of nucleic acids (replication of DNA)P

One chain of DNA it turned into the complementary chain by DNA polymerase

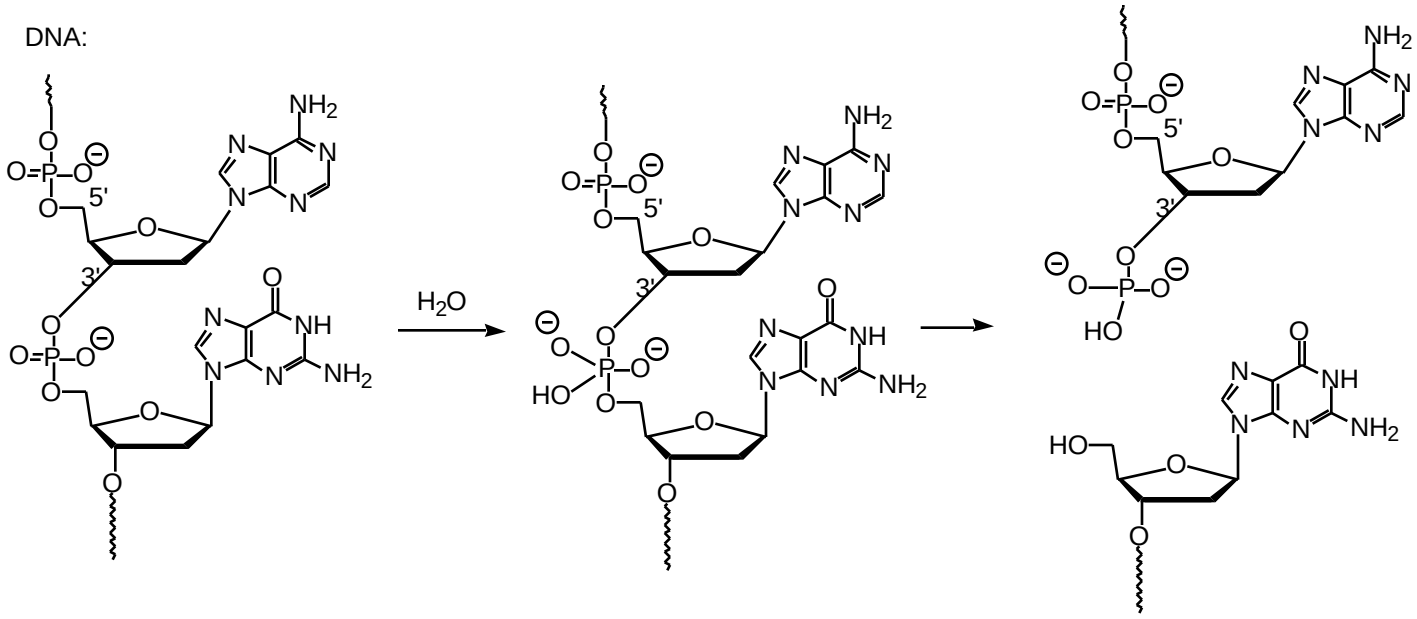
[Mechanism: overhead from Handout on Nucleic Acids]

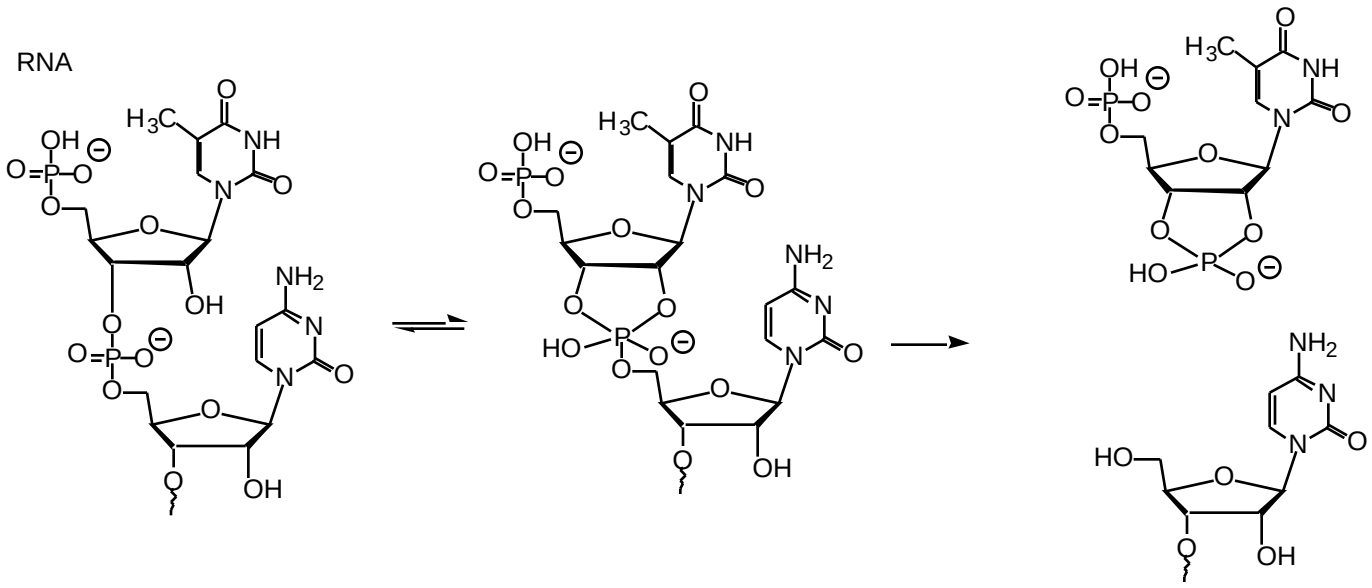
Critical step: Formation of pentacoordinate phosphorus (like tetracoordinate carbon in amide reactions)



Cleavage of DNA units is the reverse reaction, but with water as the nucleophile.

Instability of RNA:





Protein Synthesis based on the DNA Template:

Two strands of DNA in the double helix: one is "informational" and the other is the "template". The DNA unwinds and the complementary strand is "transcribed" into RNA (messenger RNA or mRNA). The mRNA leaves the nucleus of the cell, and is "translated" into protein. Transcription is like replication: RNA polymerase operating on a DNA strand with RNA nucleotides as the starting materials.

Translation requires the "lining up" of the amino acids corresponding to each unit of the triplet code (codon): Three nucleic acid bases correspond to one AA. [with 3 nucleic acids, 64 possibilities. Therefore redundance: one AA can correspond to more than one set of three nucleic acids.]

Each AA is connected to a transfer RNA [overhead] via the enzymes AMINOACYL-tRNA SYNTHETASE

The tRNAs line up along the mRNA chain by the usual H-bonding between bases [overhead]

Amide bond formation is induced, and then the next tRNA lines up and the chain is extended.

[Many intricacies not specified here--start and stop signals, exons and introns, etc] Just focus on the chemistry of H-bonding association to set up covalent bond formation.