

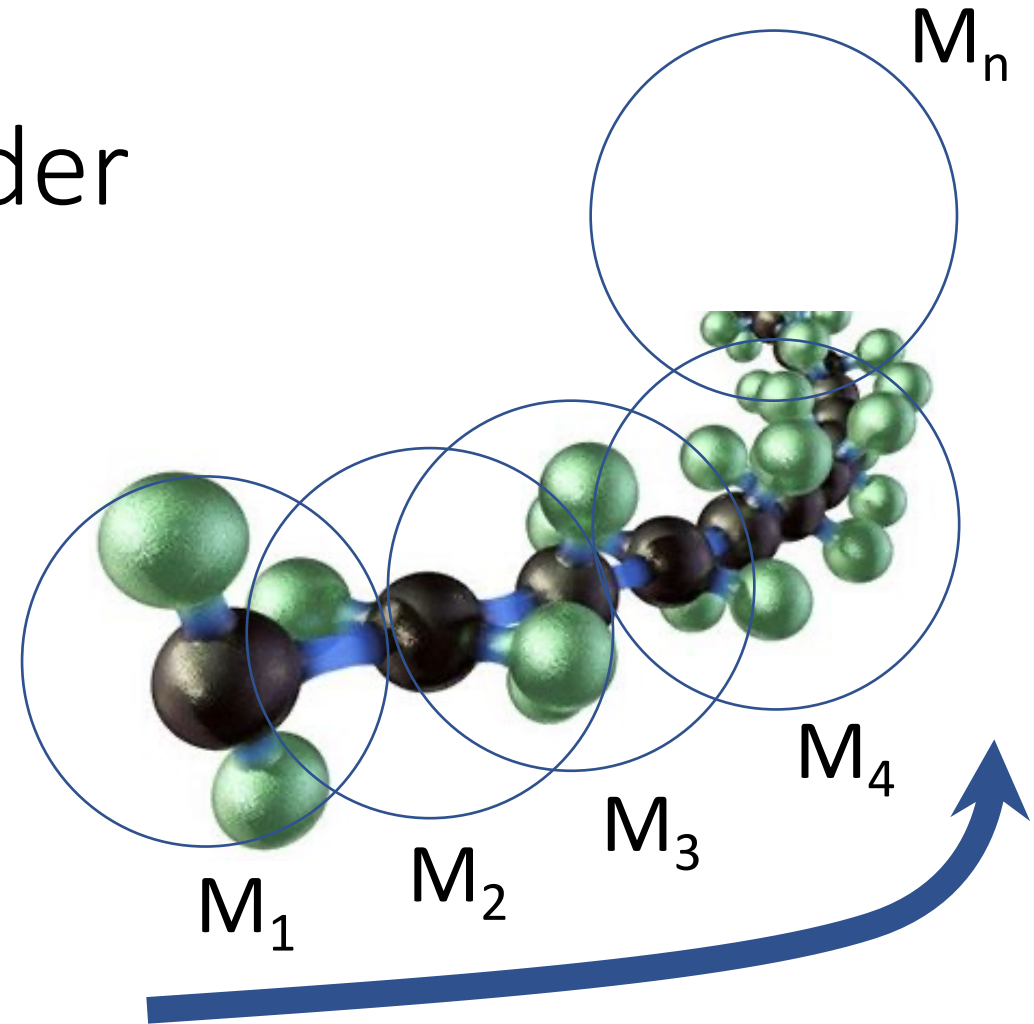
# Lesson 3

## Nucleic acids - polarity and structure



# Macromolecules' Law & Order

- Macromolecules carry information as:
  - They have two ends (starting and terminal end)
  - They have a direction (from start to end)

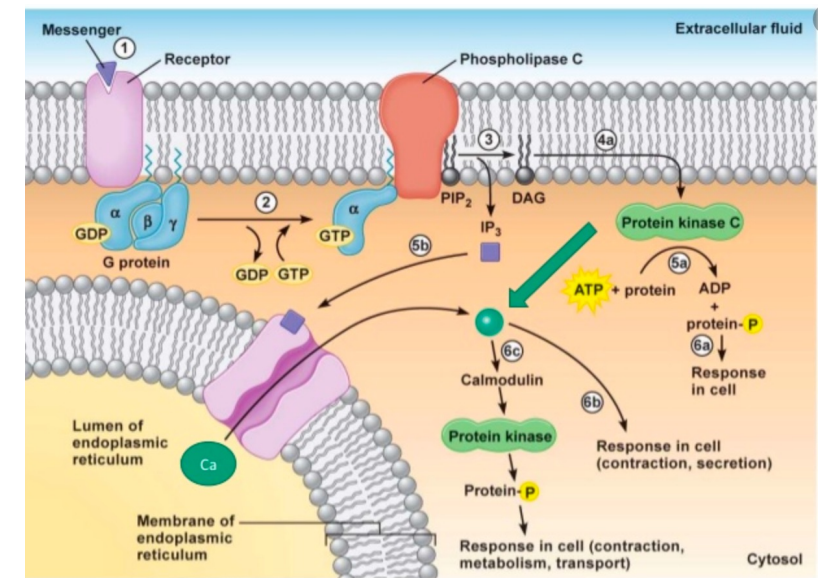
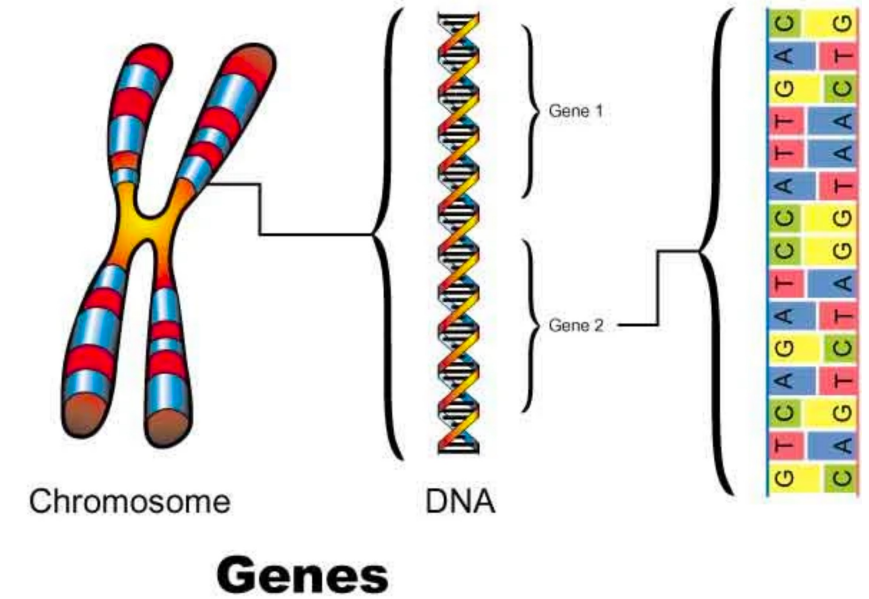


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  - These two features constitute the **FUNDAMENTAL INFORMATION** cellules can read and understand

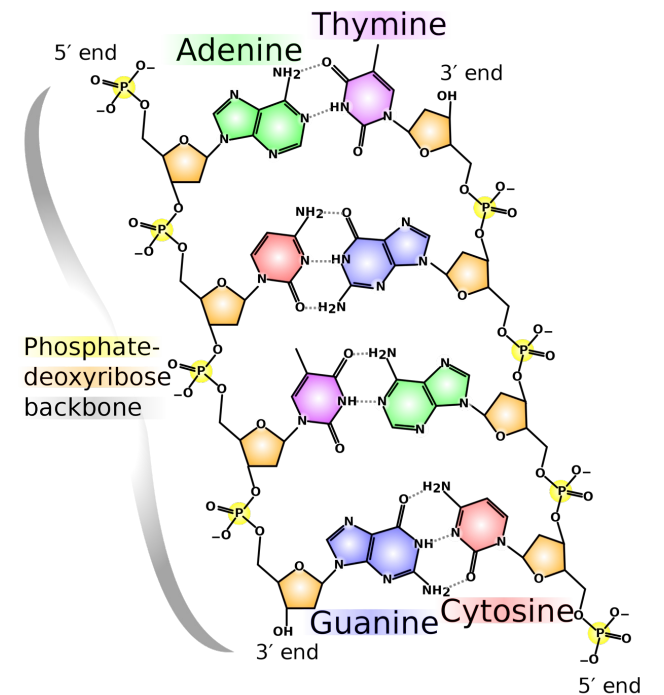
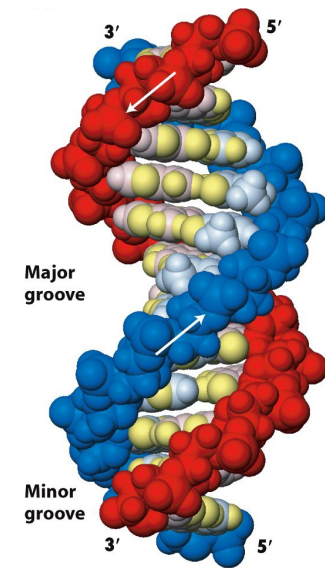
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- NUCLEIC ACIDS = carries of hereditary information
- PROTEINS = all other info/instructions



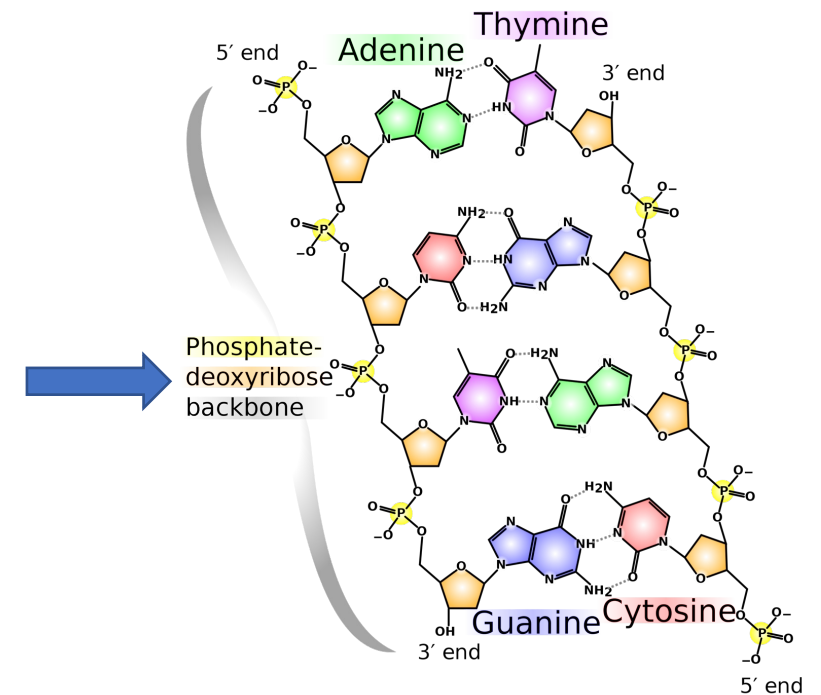
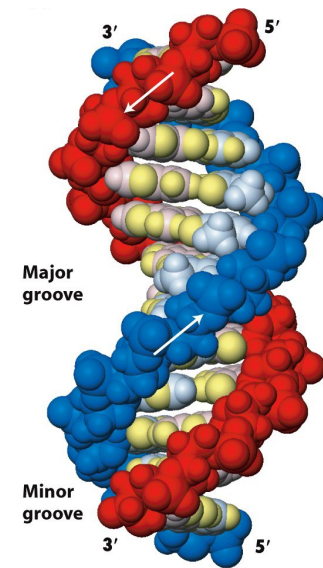
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- Have two hands: 5' e 3'  $5'P-S-P-S-P-S3'$   
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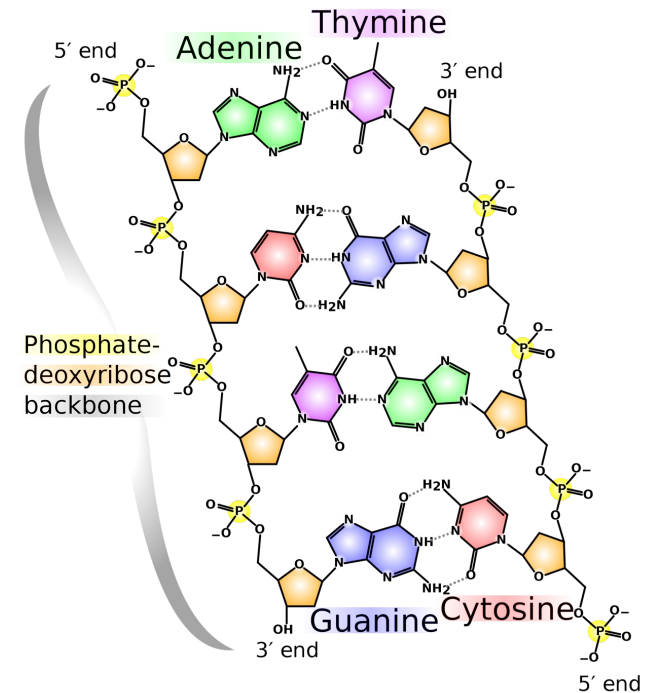
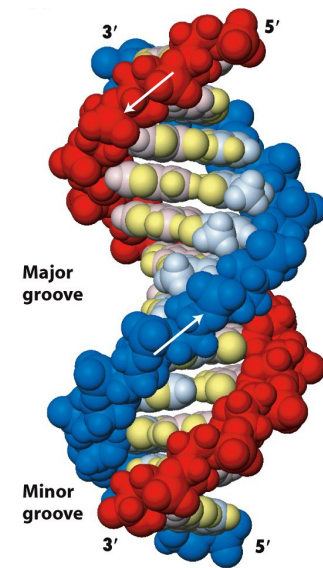
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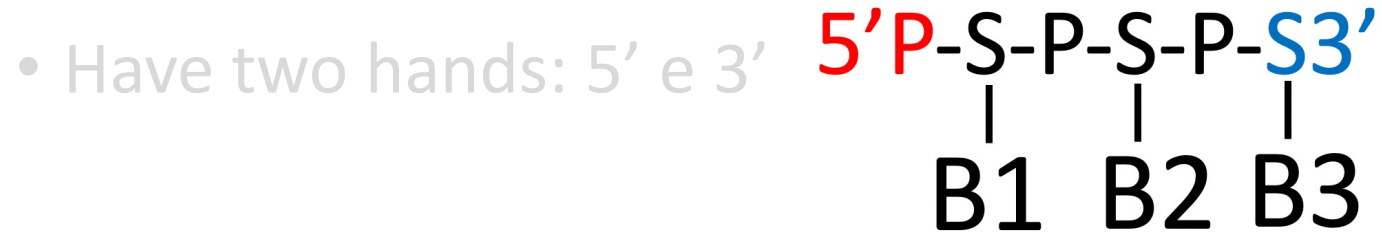


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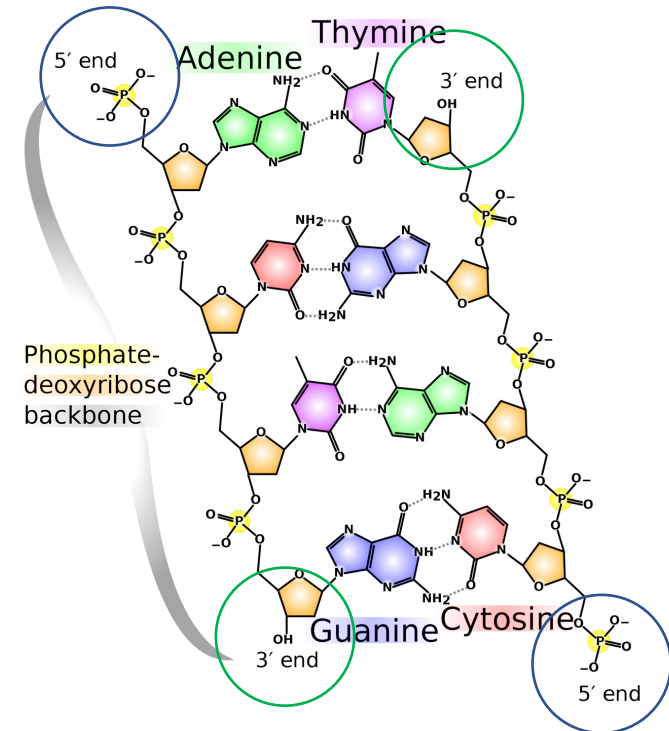
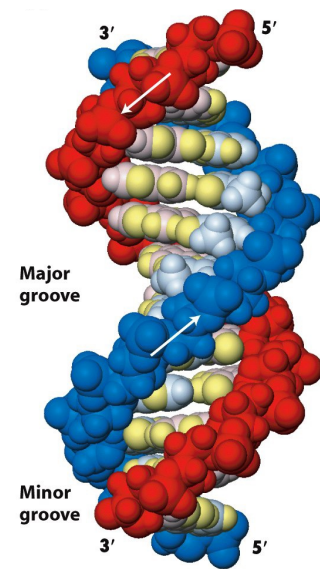
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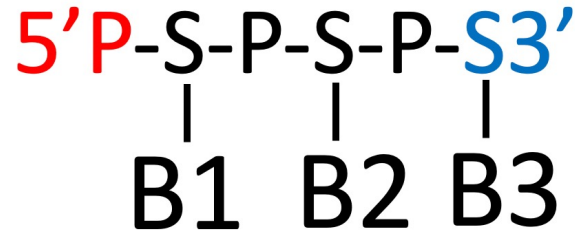
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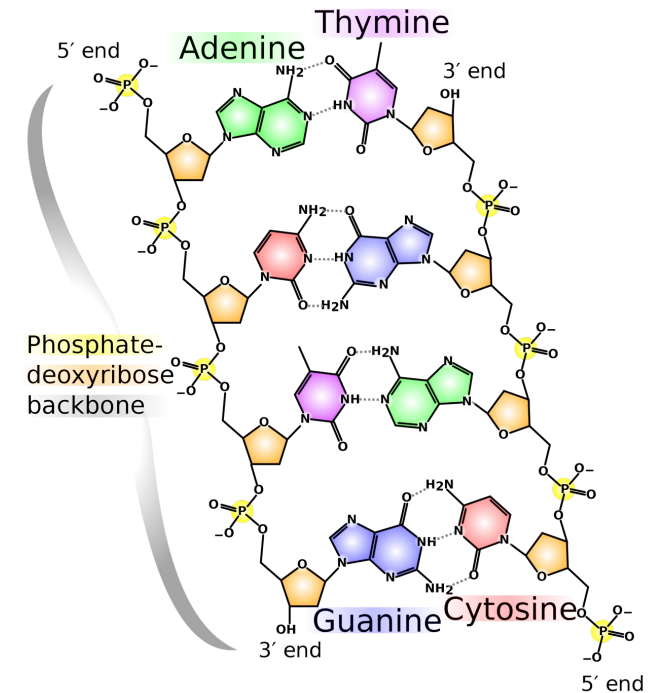
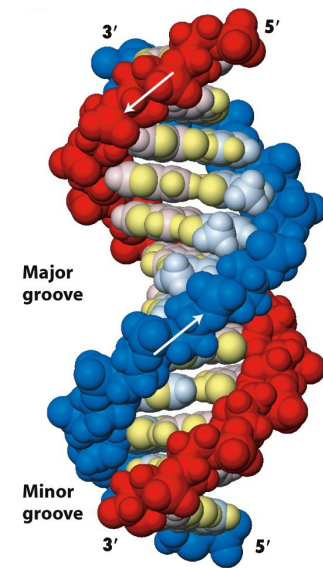


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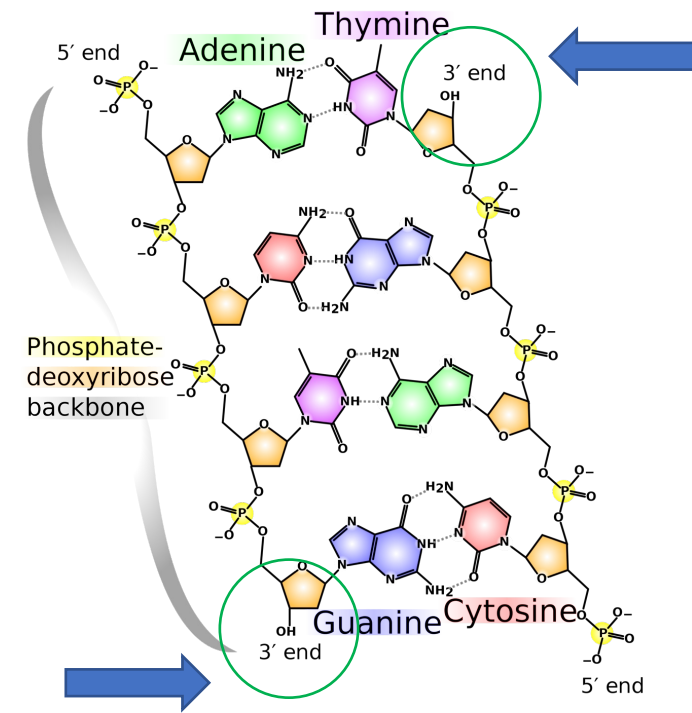
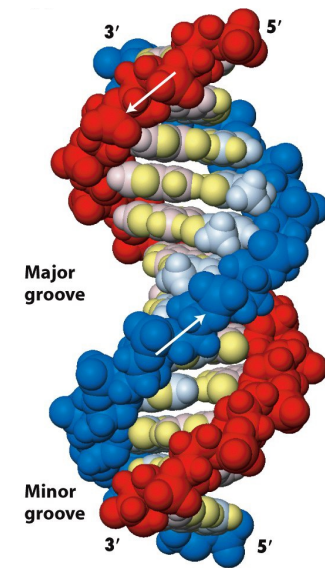


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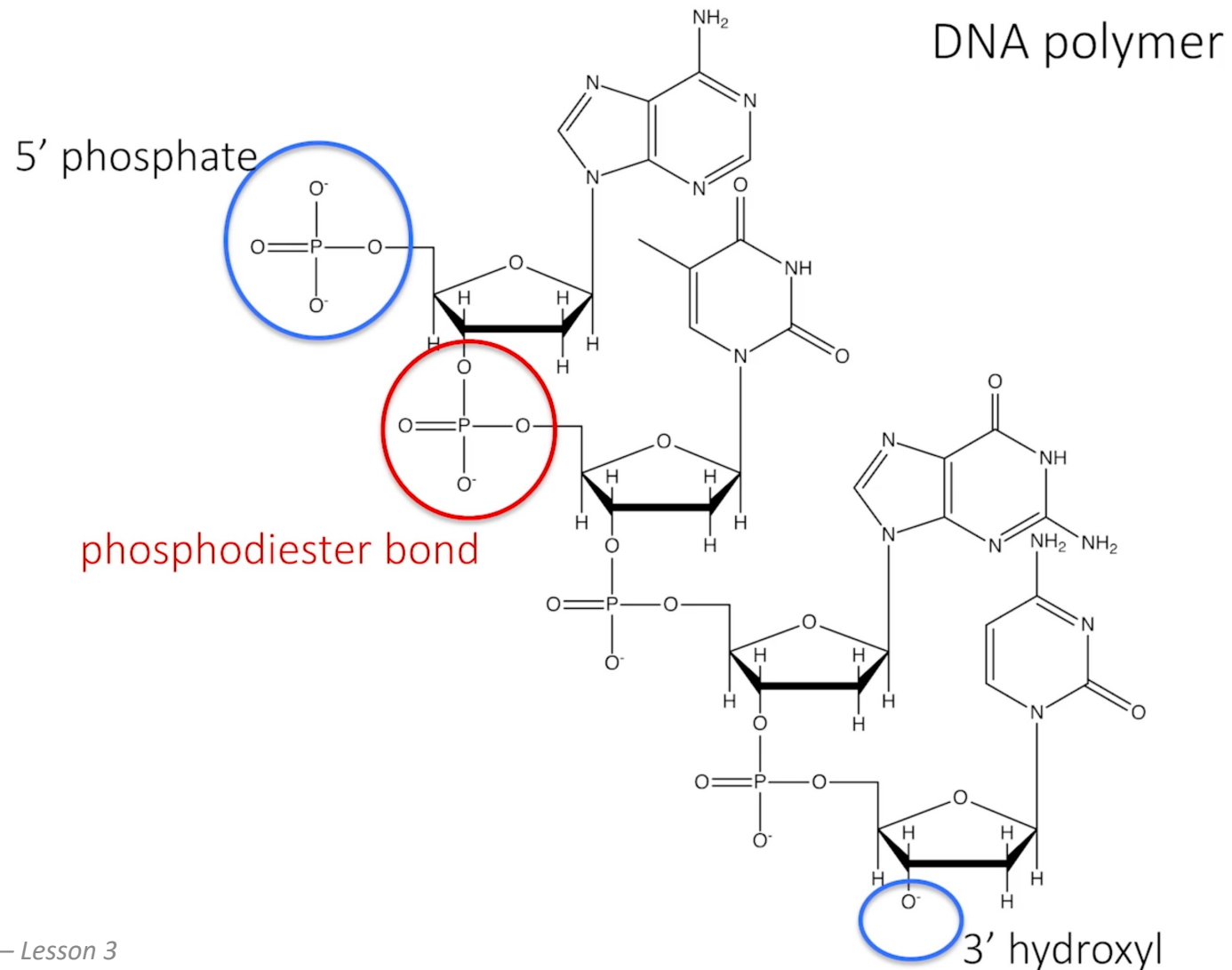


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- 3' is the last base added (any new incoming base will be added to 3'OH)



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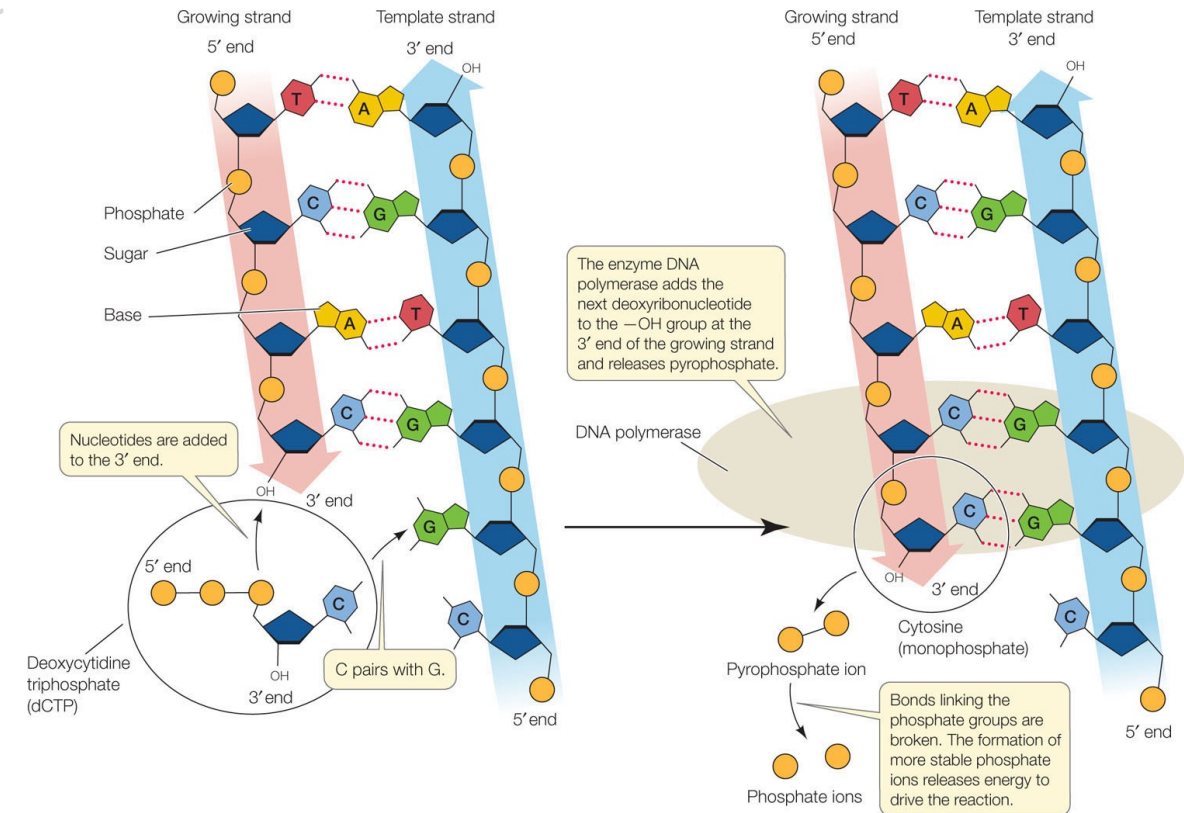
$5'B_1B_2B_3B_4B_5B_63' = 5'GAATCC3'$

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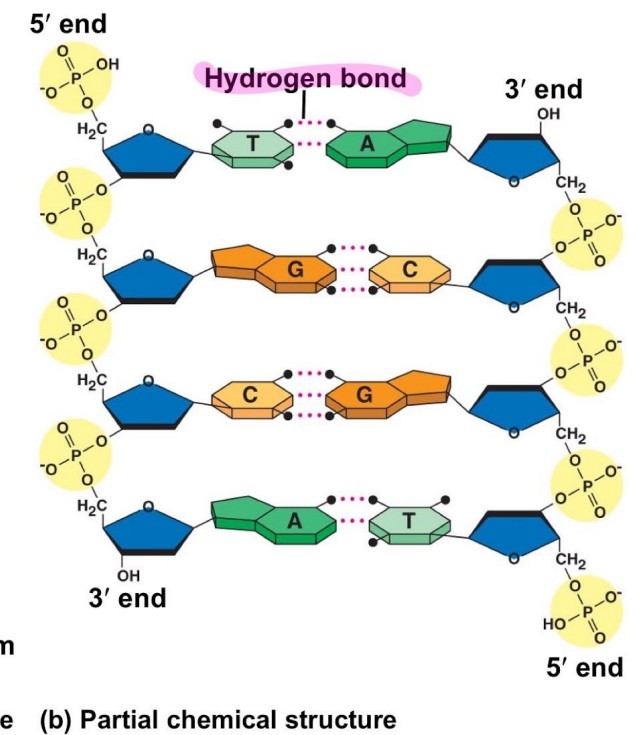
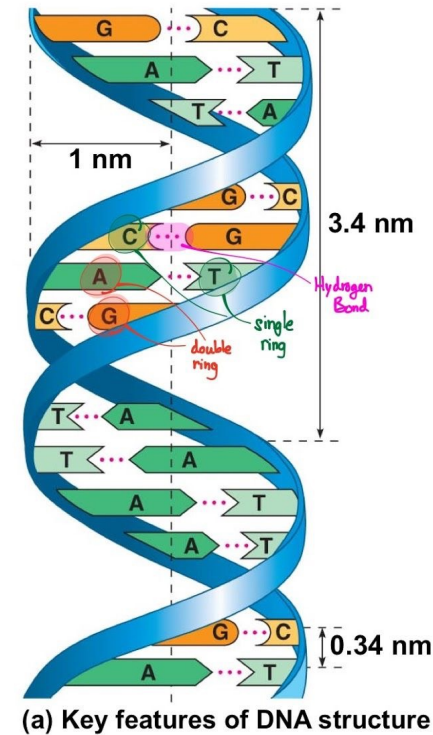
- Base order = INFORMATION
- Polarity = 5' and 3' ends: shows
  - First to last nucleotide added
  - Direction to read information





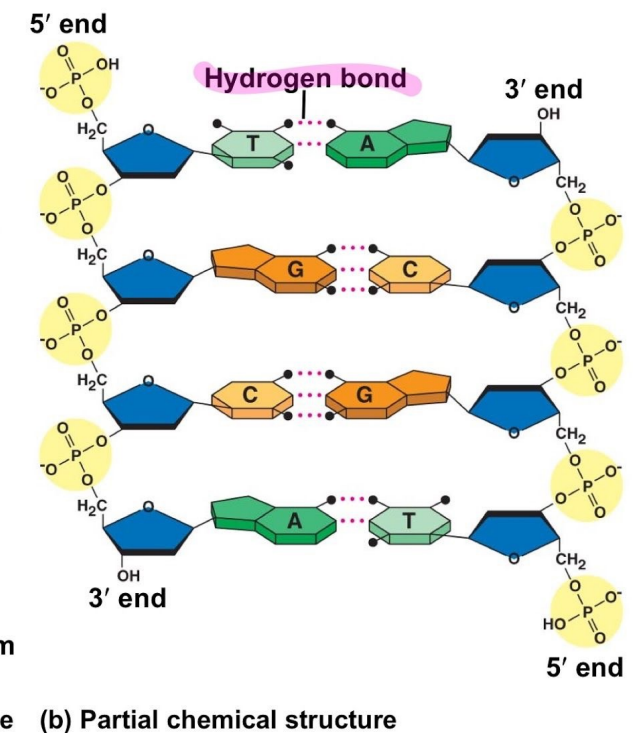
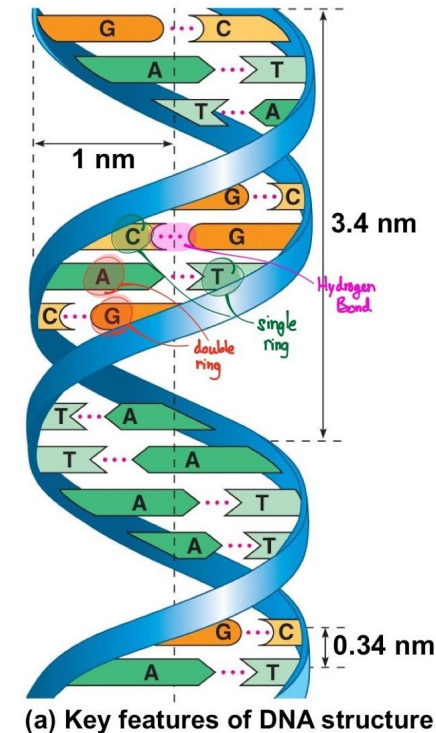
# Get to know your DNA structure

- DNA has a right-handed double-helix (DH) structure (2 nm diameter)
  - Ss and Ps lie on the outside of the helix (backbone)
  - Bs are stacked in the interior, in pairs
    - B pairs (BPs) are bound to each other by H-bonds
    - Every BP in the DH is separated from the next base pair by 0.34 nm (**axial rise**)
    - There are 10.4 BPs per helical turn
  - The distance to complete one helical turn (**helical pitch**) = 3.4 nm



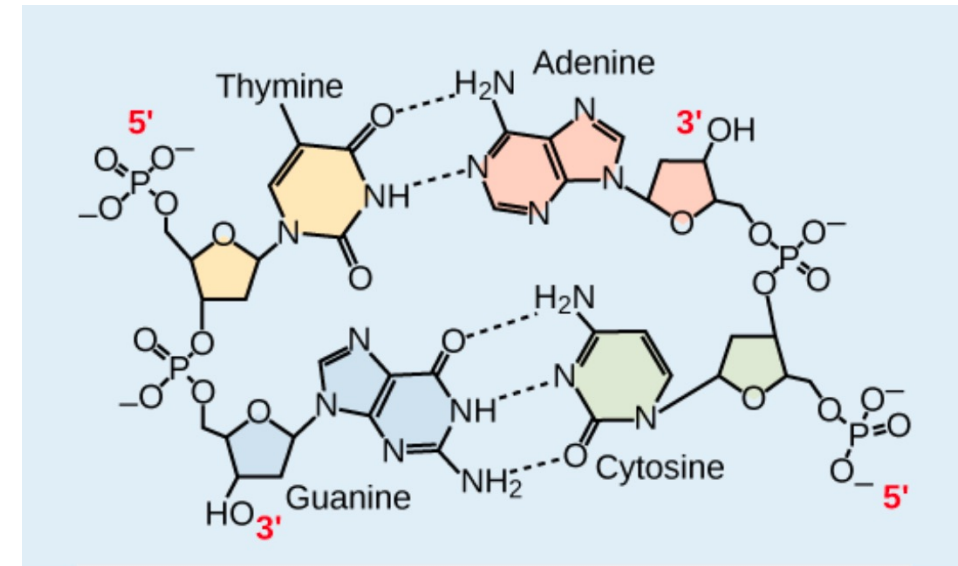
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    - There are 10.4 BPs per helical turn
  - The distance to complete one helical turn (helical pitch) = 3.4 nm
- The two strands of the helix run in opposite directions
  - the 5' carbon end of one strand will face the 3' carbon end of its matching strand
- This is referred to as **antiparallel orientation**
  - **Key DNA PROPERTY** (for DNA replication and in many nucleic acid interactions)



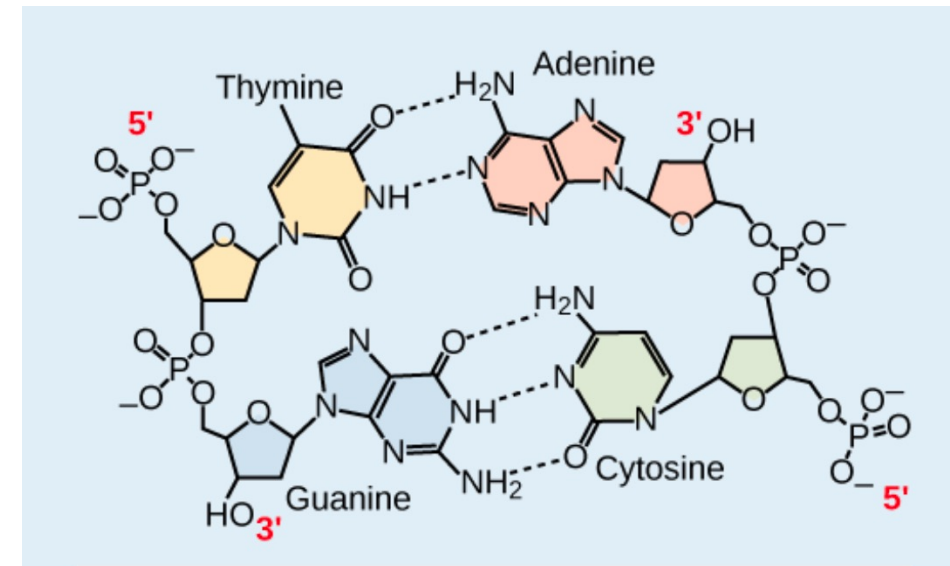
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- In other words, the DNA strands are complementary to each other
  - If the sequence of one DNA strand is **5'AATTGGCC3'**, the complementary strand would have the sequence **3'TTAACCGG5'**

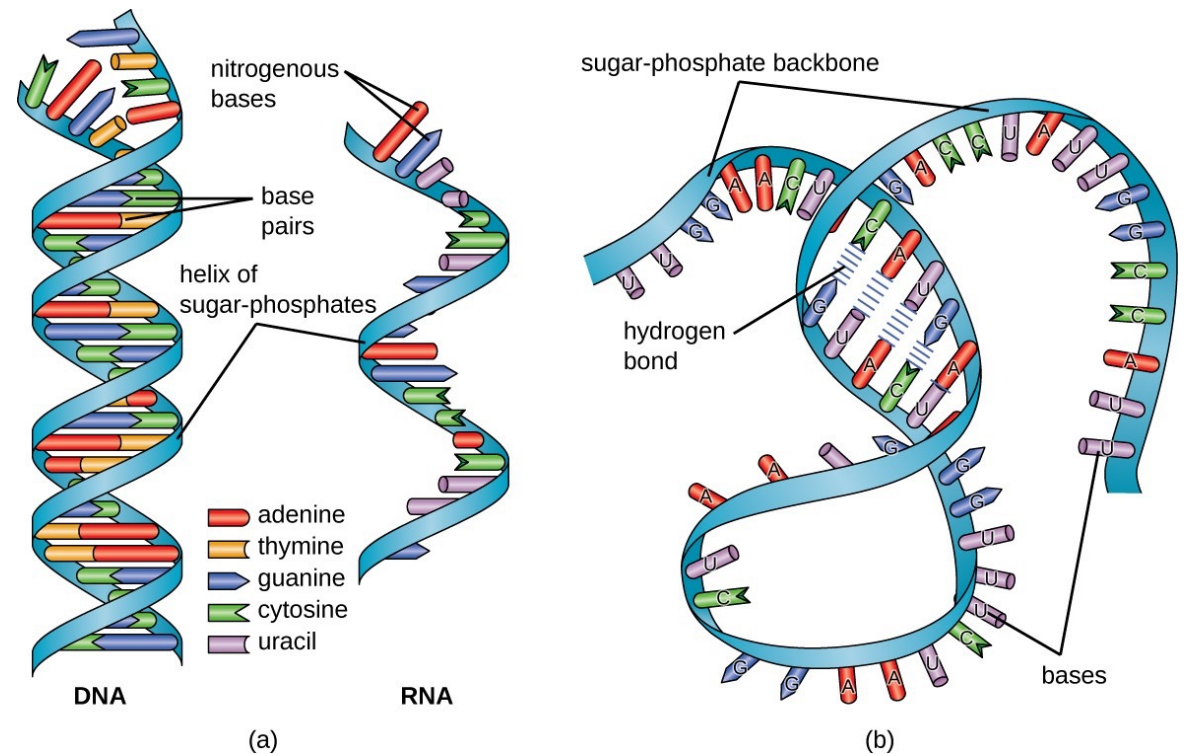


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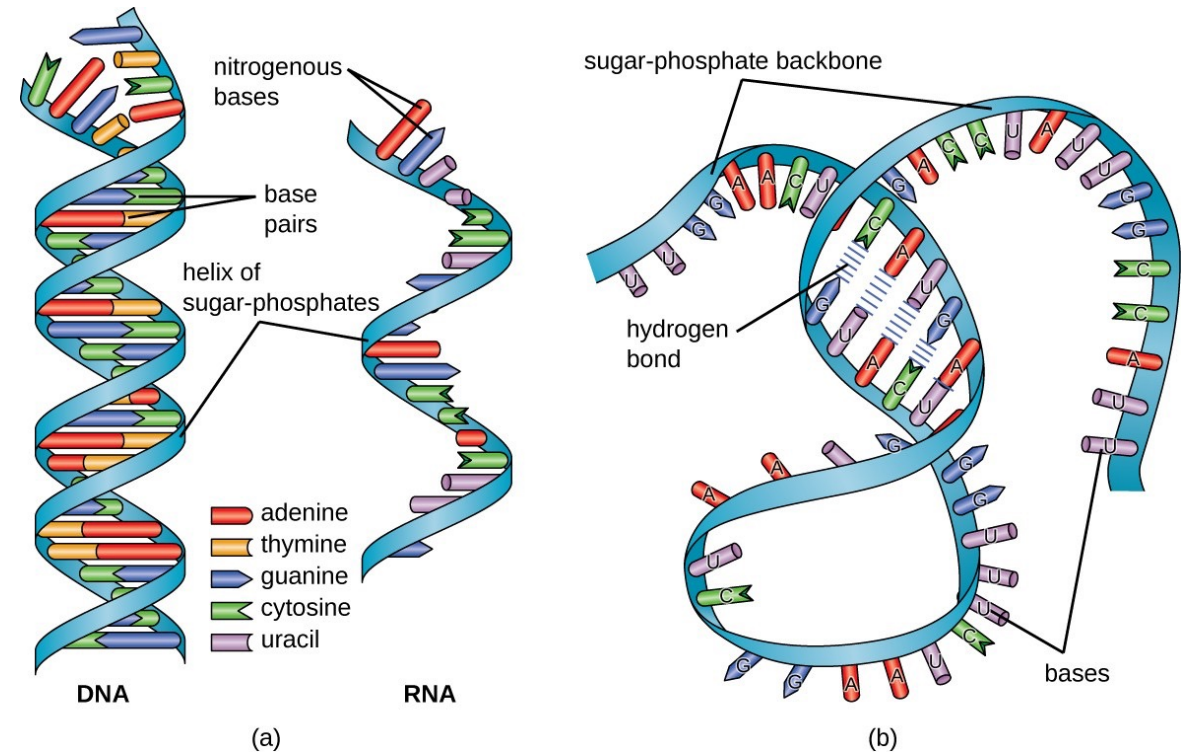
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- RNA is usually single-stranded
- The RNA four nitrogenous bases are A, U, G, and C
- There are four major types of RNA
  - messenger RNA (mRNA), ribosomal RNA (rRNA), transfer RNA (tRNA), and microRNA (miRNA) (more later)



# RNA structure

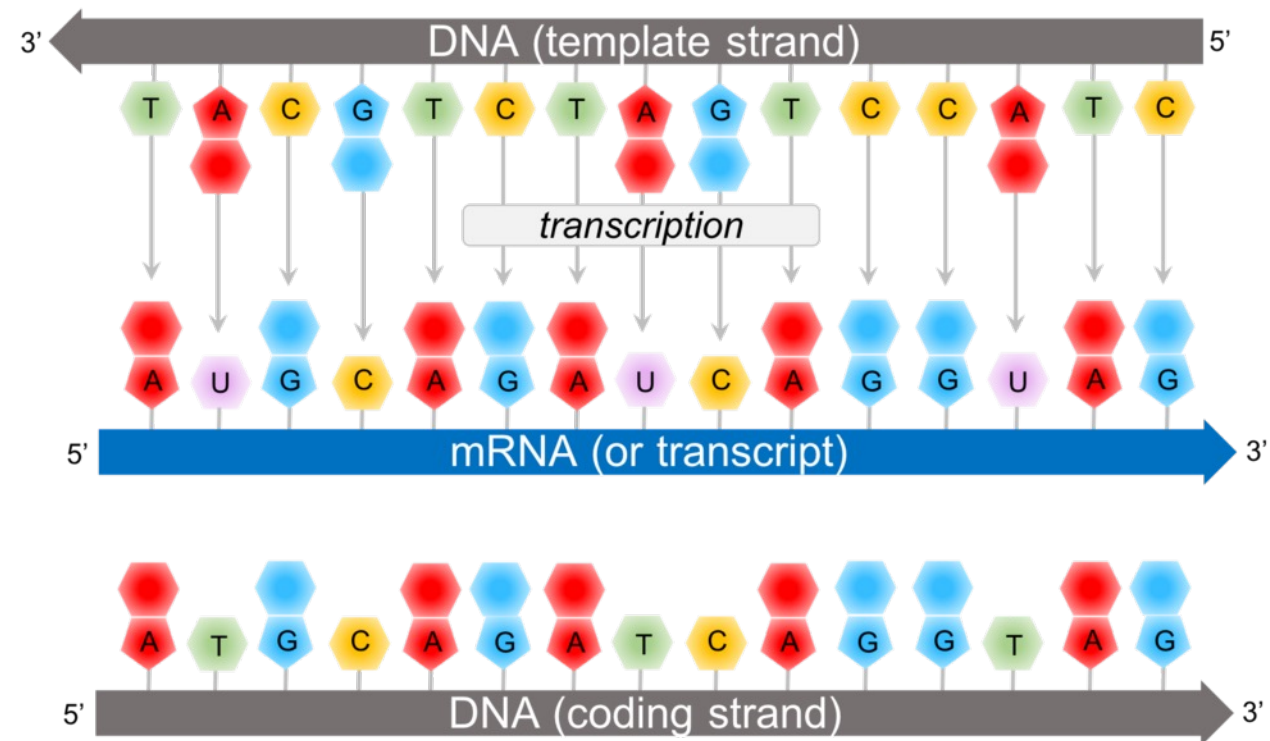
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- If the DNA strand to be copied (**template strand**) has a sequence **3'TACGTCTA...3'**, the sequence of the complementary mRNA strand (**transcript**) is **5'AUGCAGAU...3'**



Note: template strand reading is 3' → 5'  
mRNA synthesis is 5' → 3'  
(more later)