Lesson 3
Nucleic acid polarity and structure

Macromolecules' Law & Order

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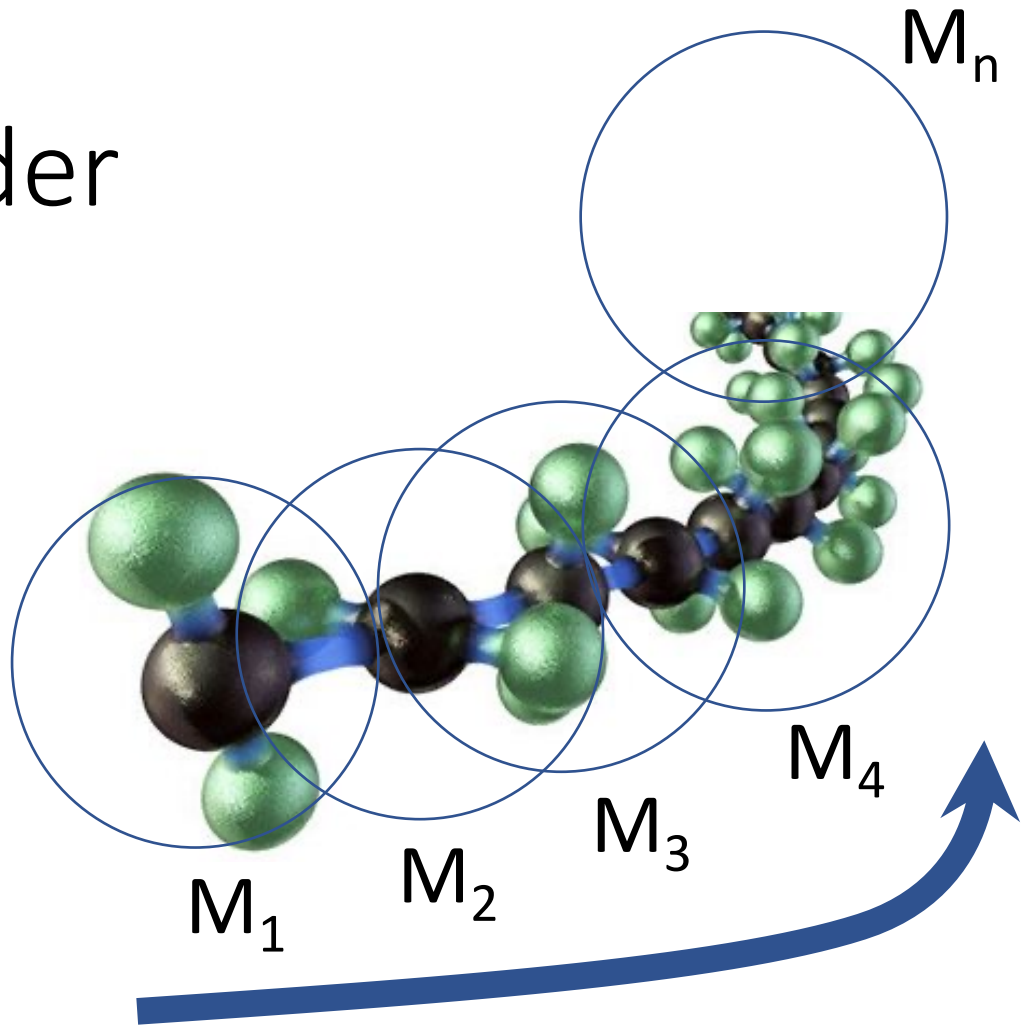
  - They have a direction (from start to end)



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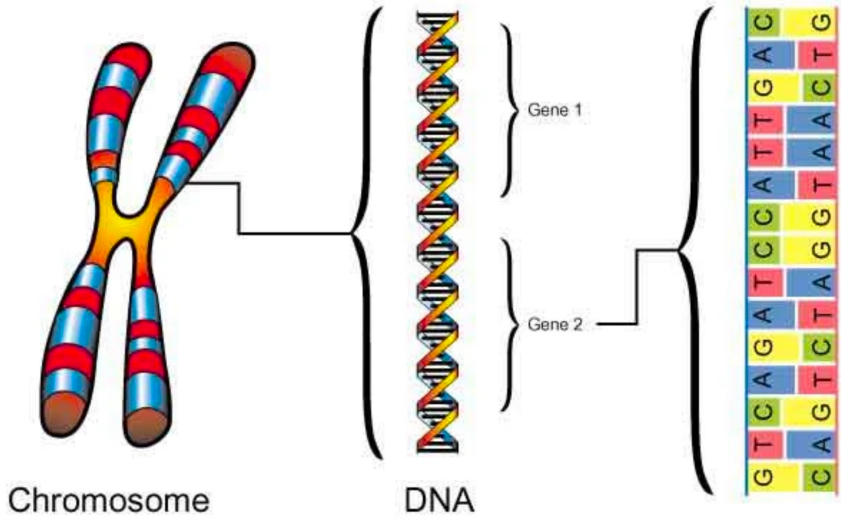
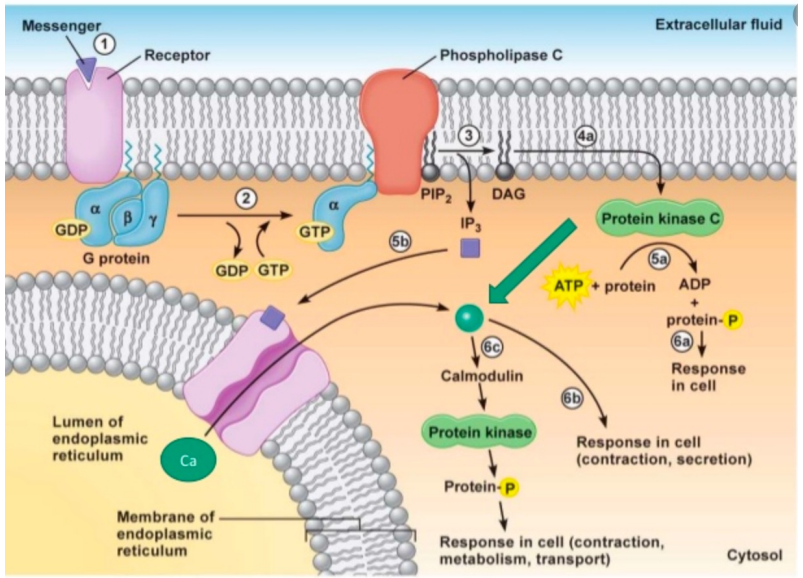
- NUCLEIC ACIDS = carries of hereditary information
- PROTEINS = all other info/instructions





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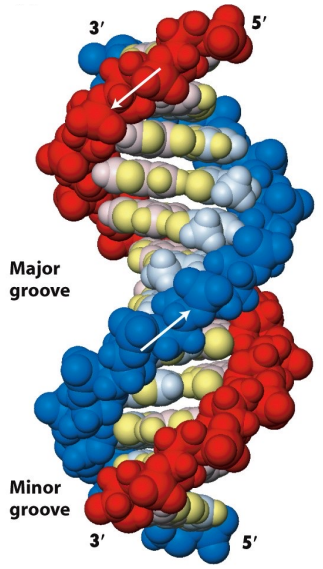

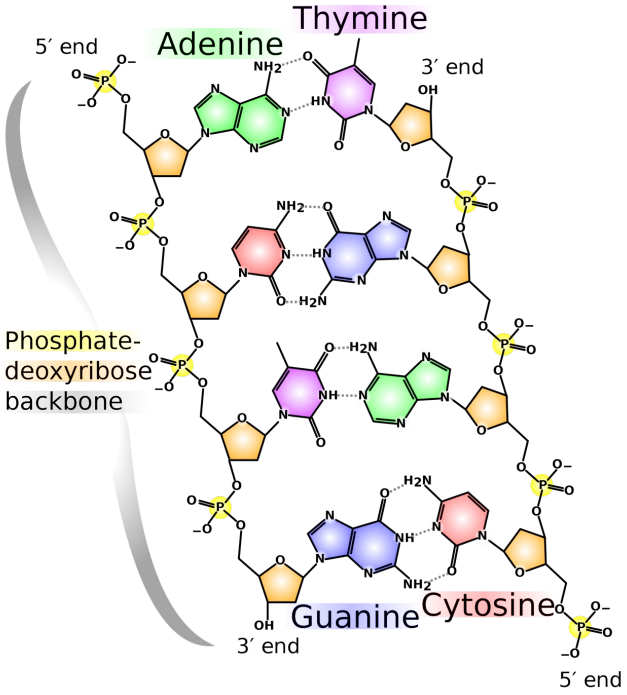

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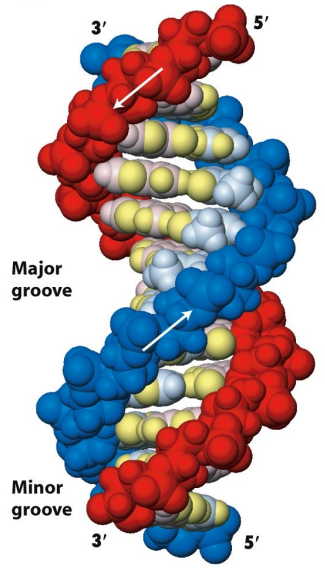

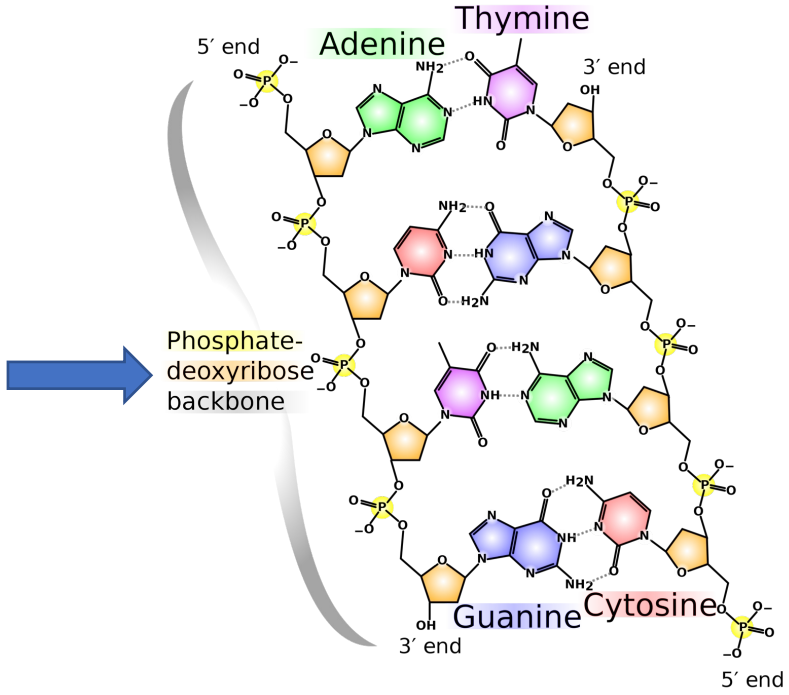

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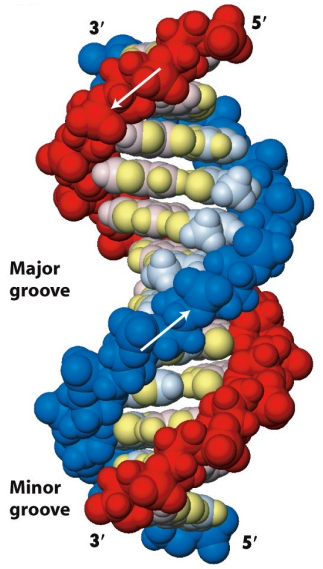

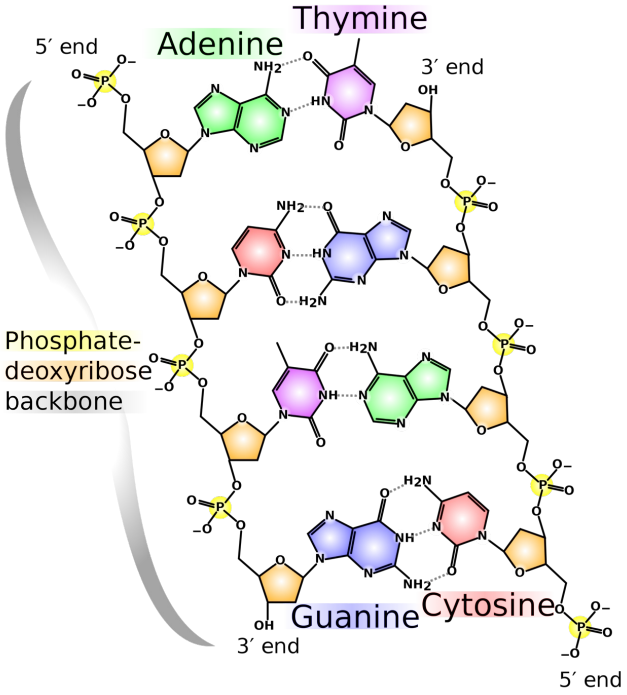

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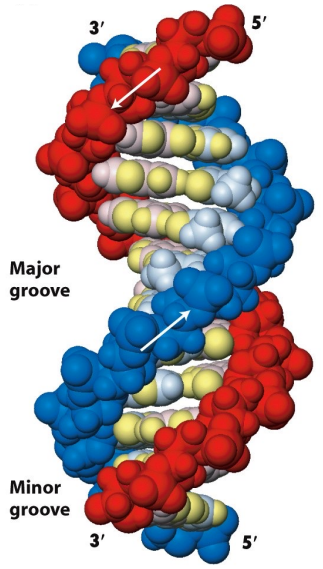

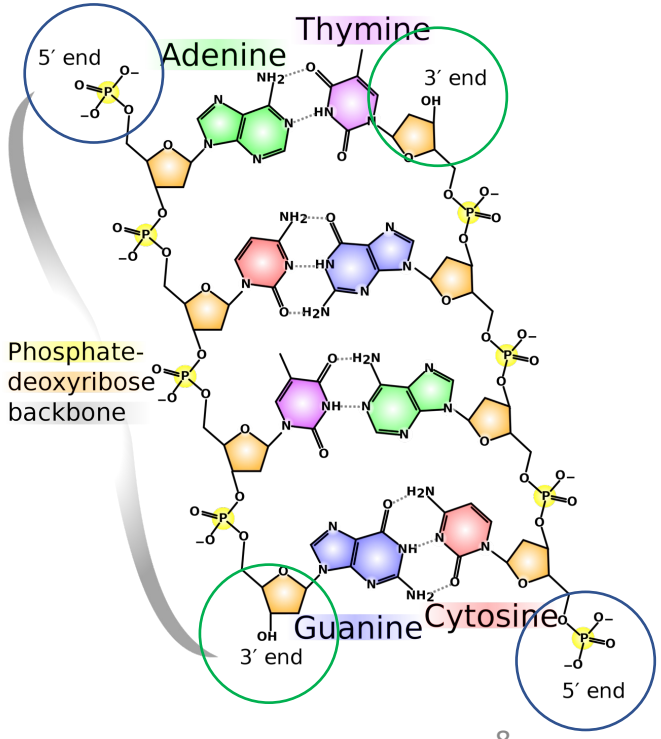

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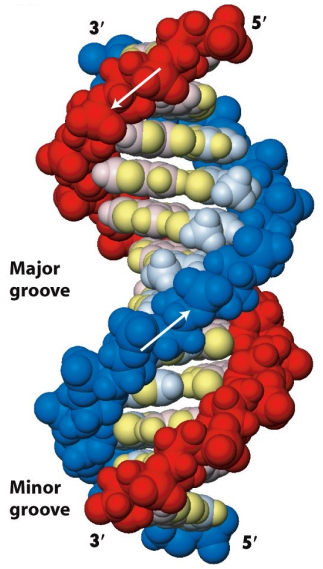

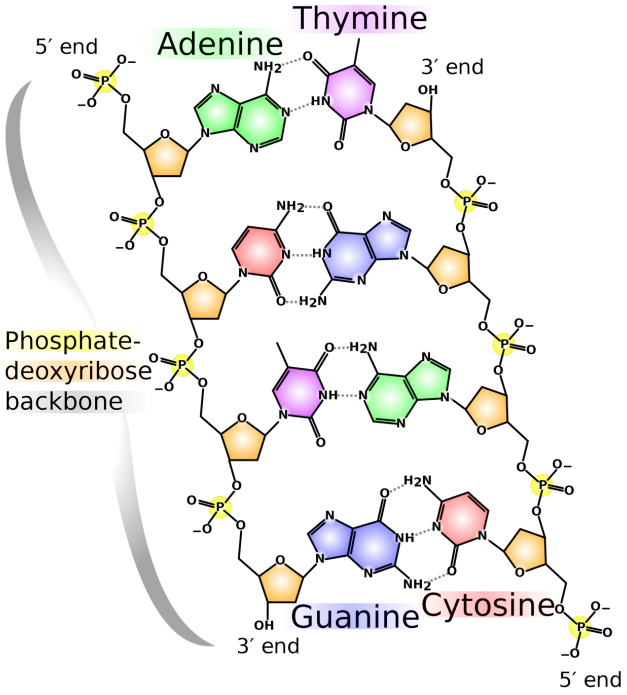

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- Polarity:
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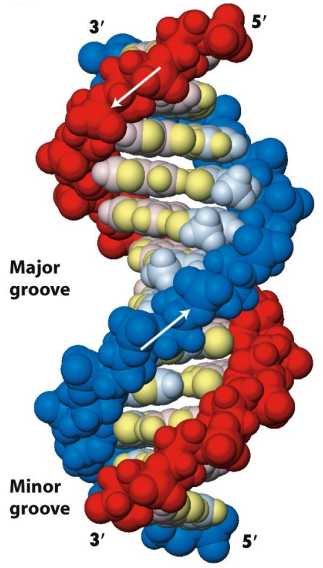
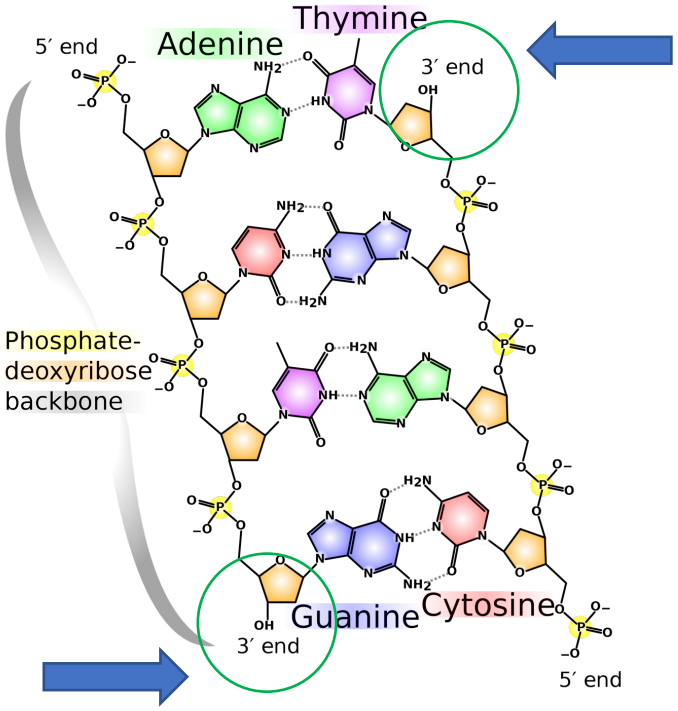
  - 3’end = 3’OH on sugar
- Base order along the polymer
- 3’ is the last base added (any new incoming base will be added to 3’OH)





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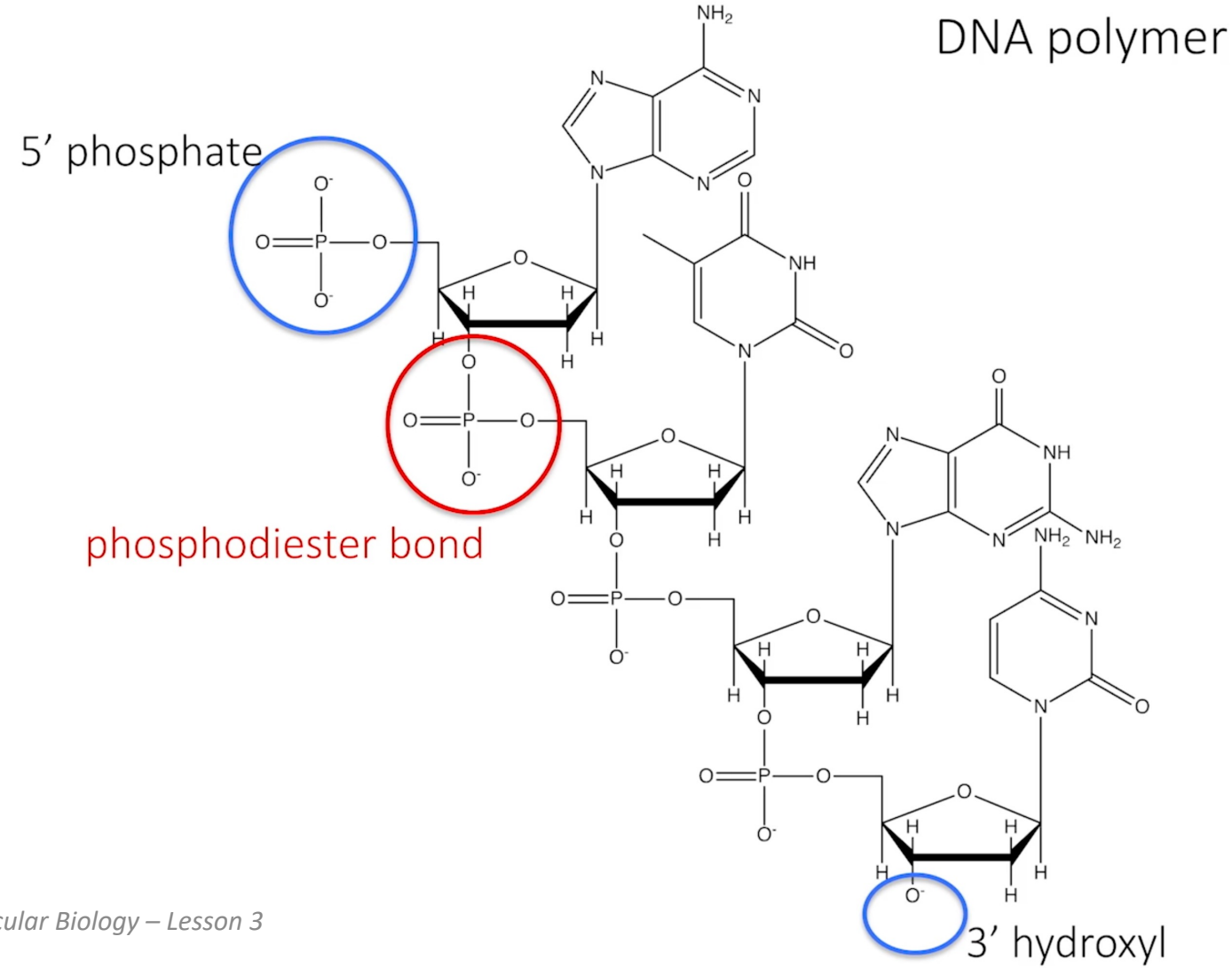

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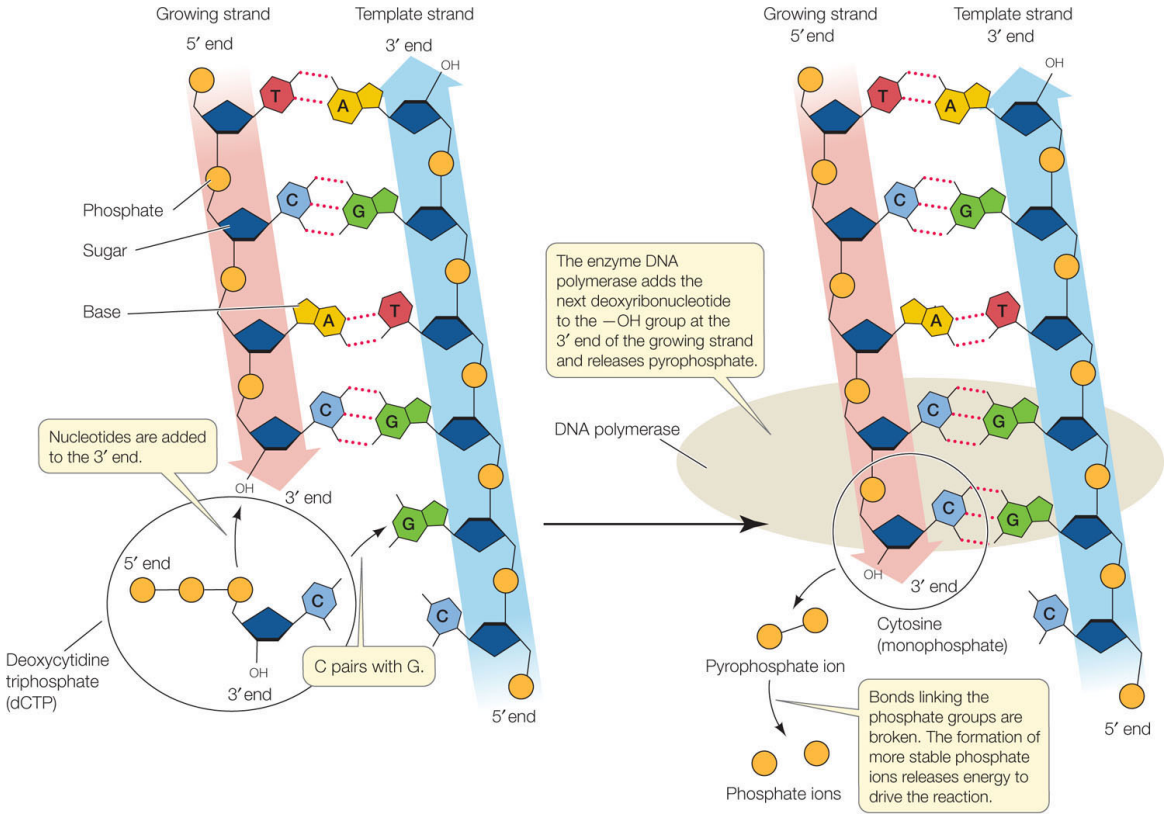
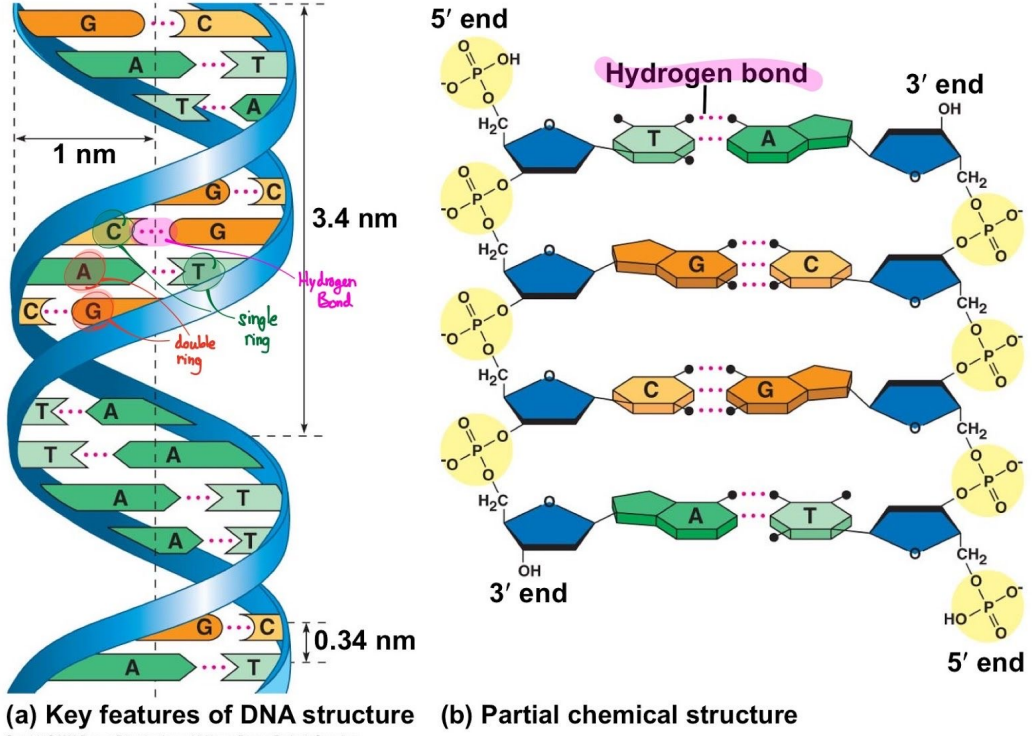
  $5'B_1B_2B_3B_4B_5B_6 3' = 5'GAATCC3'$

- 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 trun
  - The distance to complete one helical turn (helical pitch) = 3.4 nm



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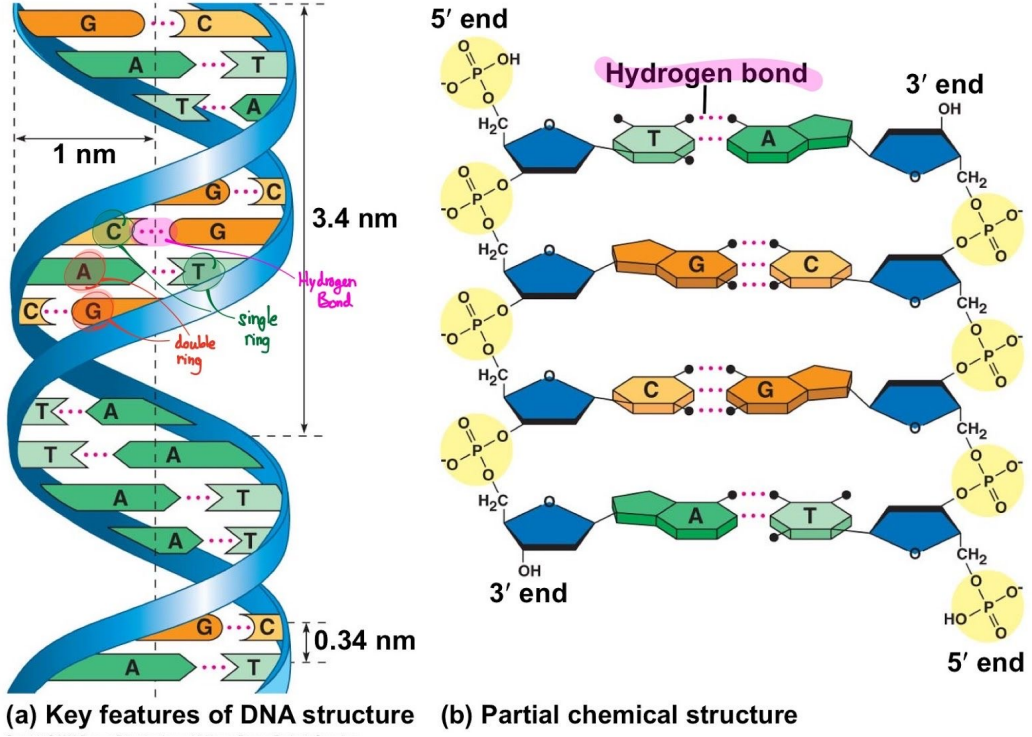
  - The distance to complete one helical turn (helical pitch) = 3.4 nm
- The two strands of the helix run in opposite directions
  - the 5′ carbon end of one strand will face the 3′ carbon end of its matching strand
- This is referred to as **antiparallel orientation**
  - **Key DNA PROPERTY** (for DNA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



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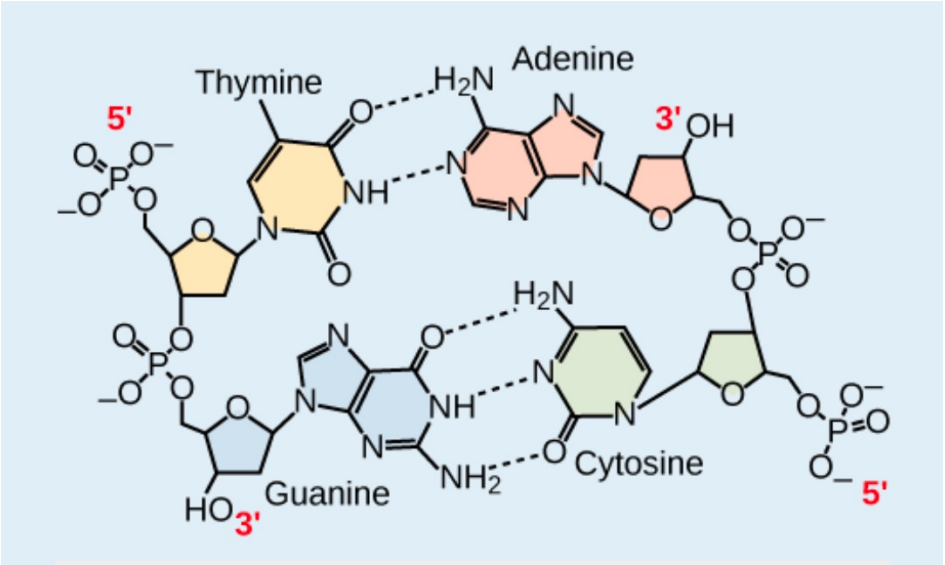
- Specifically: A can only pair with T and G can only pair with C (**base complementary rule**)



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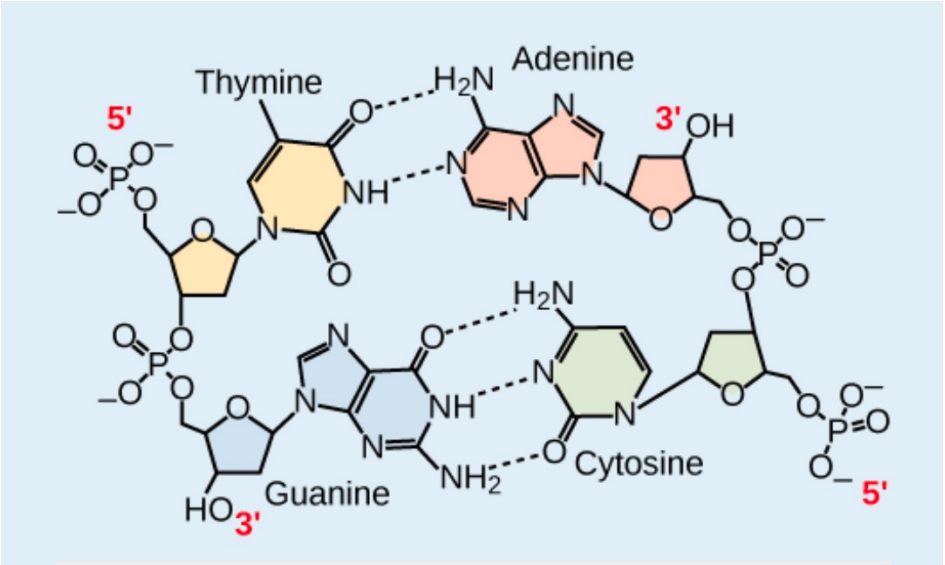
- Specifically: A can only pair with T and G can only pair with C (**base complementary rule**)
- In other words, the DNA strands are complementary to each other
  - If the sequence of one DNA strand is **5'AATTGGCC3'**, the complementary strand would have the sequence **3'TTAACCGG5'**



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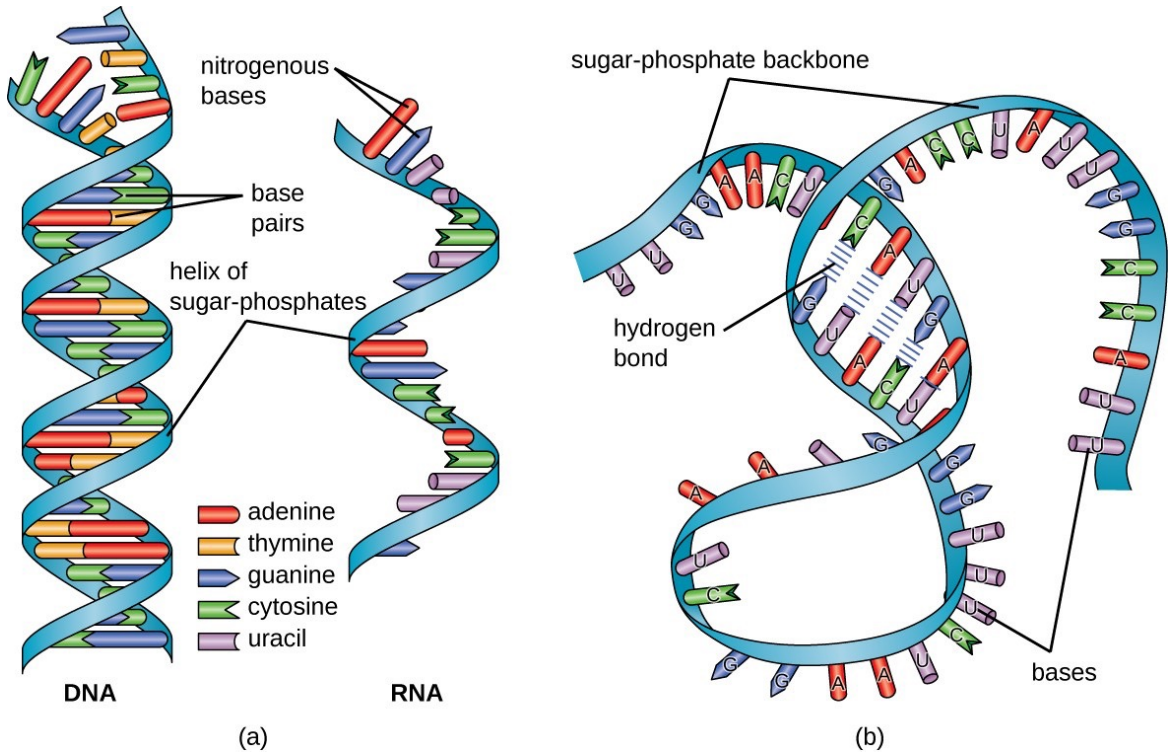

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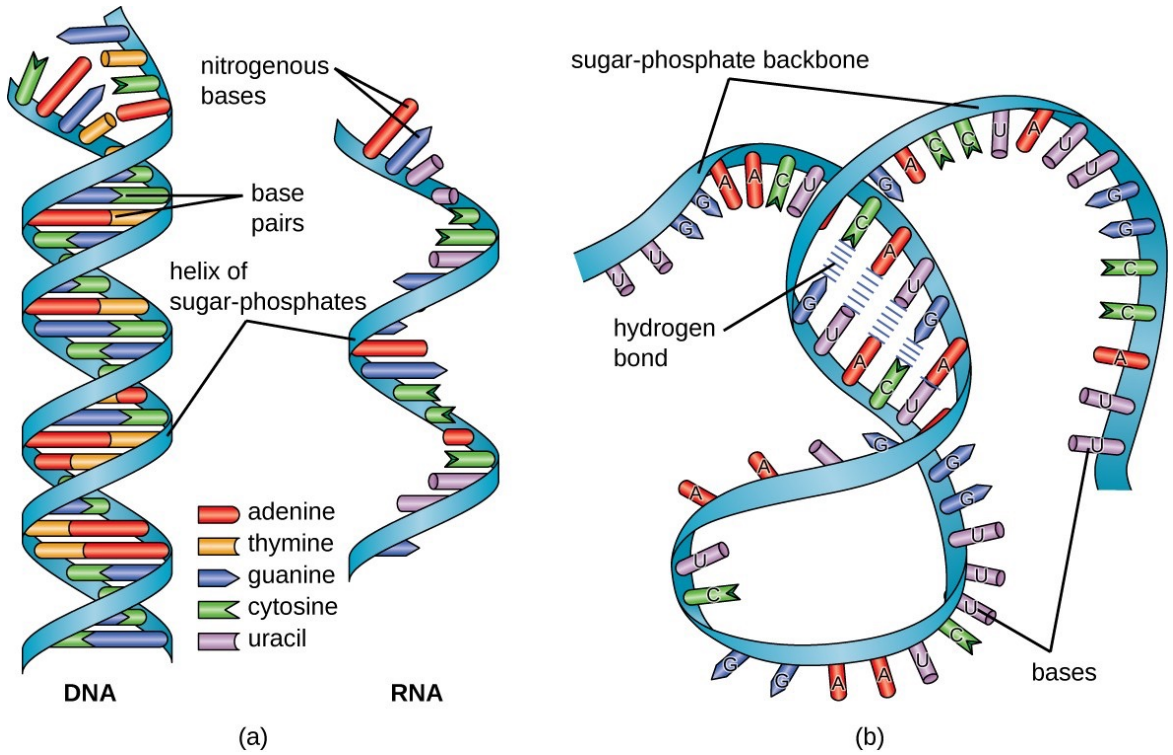
- There are four major types of RNA
  - messenger RNA (mRNA), ribosomal RNA (rRNA), transfer RNA (tRNA), and microRNA (miRNA) (more later)



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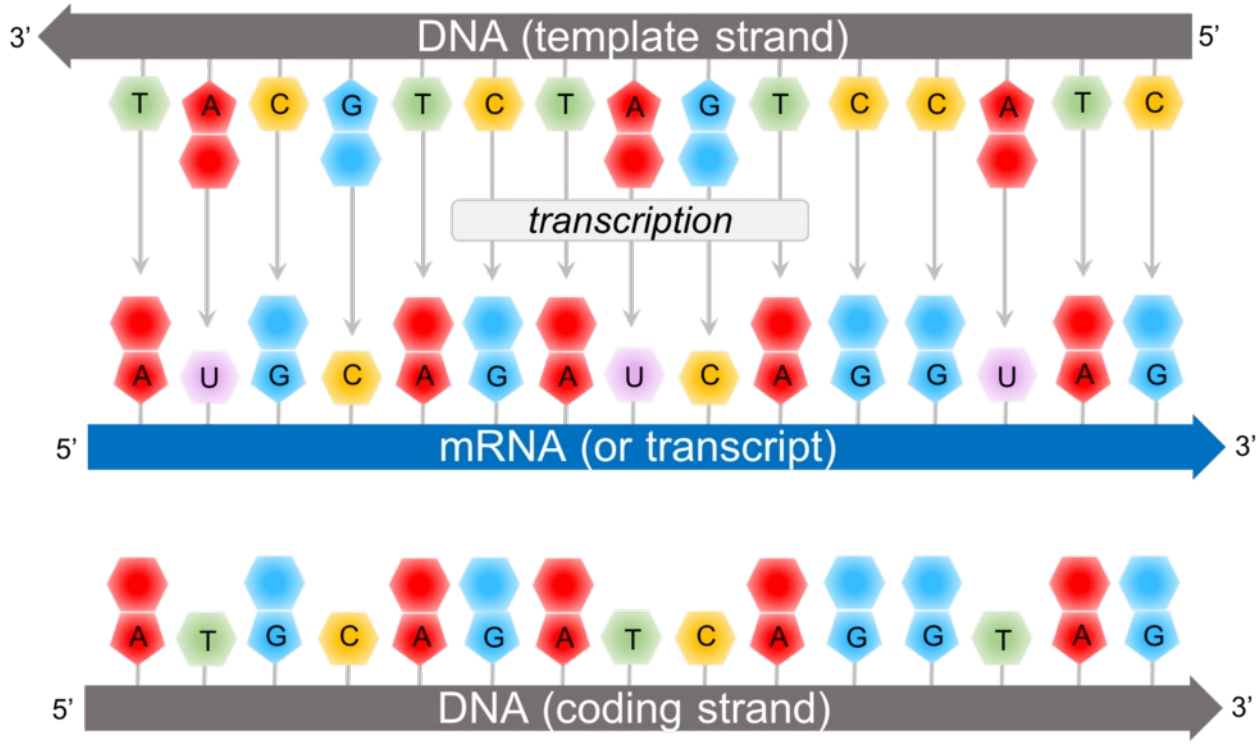
- If the DNA strand to be copied (template strand) has a sequence **3'TACGTCTA…3'**, the sequence of the complementary mRNA strand (transcript) is **5'AUGCAGAU…3'**



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