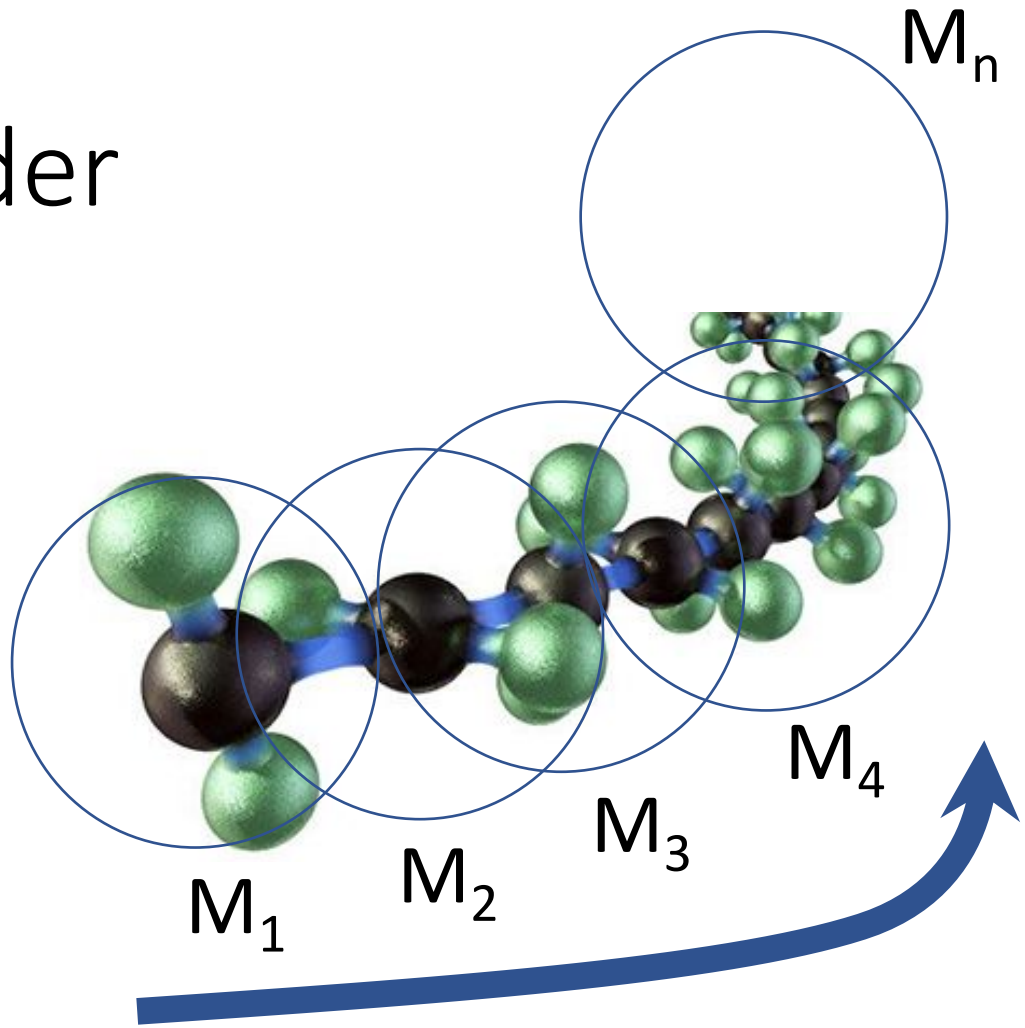
Lesson 2
Nucleic acid polarity and structure

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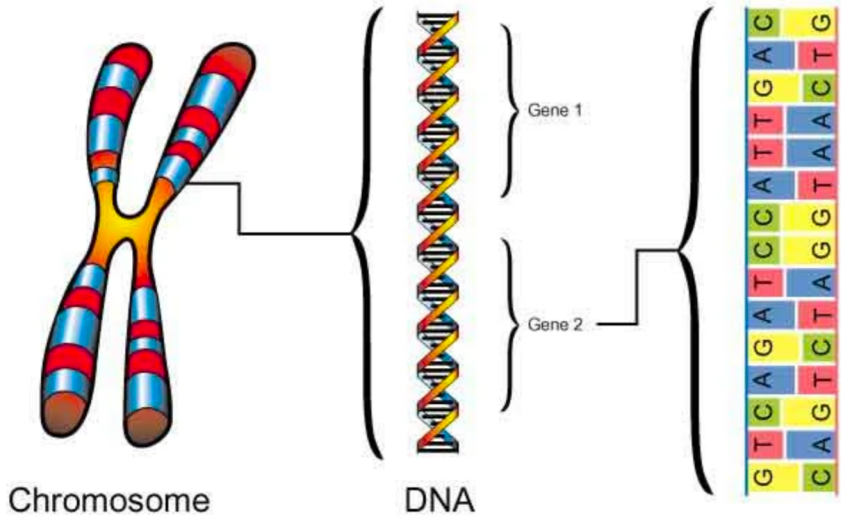
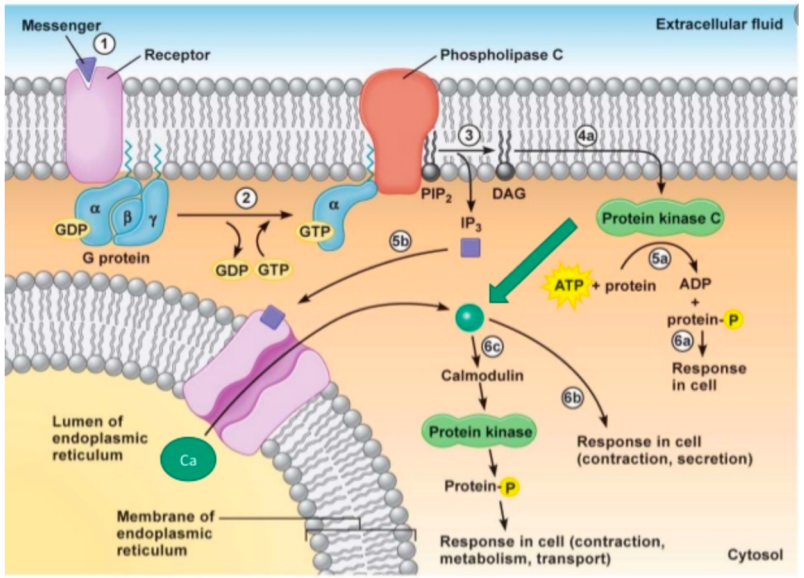
- NUCLEIC ACIDS = carries of hereditary information
- PROTEINS = all other info/instructions





Nucleic acid polarity

- Have two hands: 5’ e 3’

5’P-S-P-S-P-S3’

B1 B2 B3

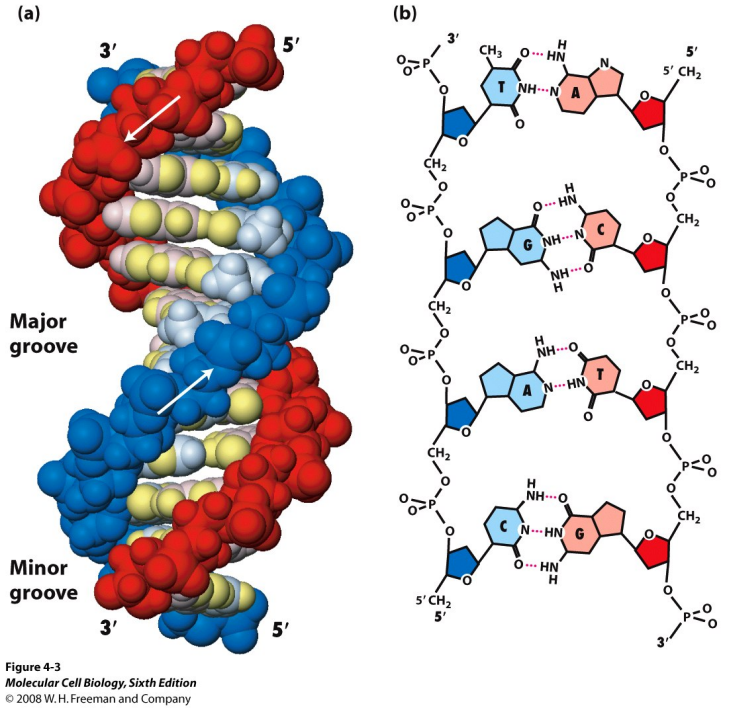


Figure 4-3
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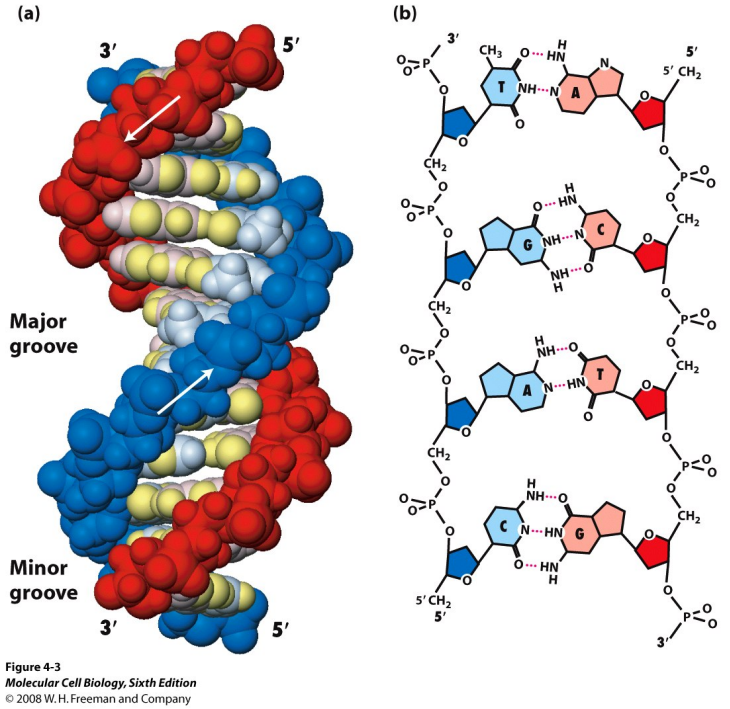

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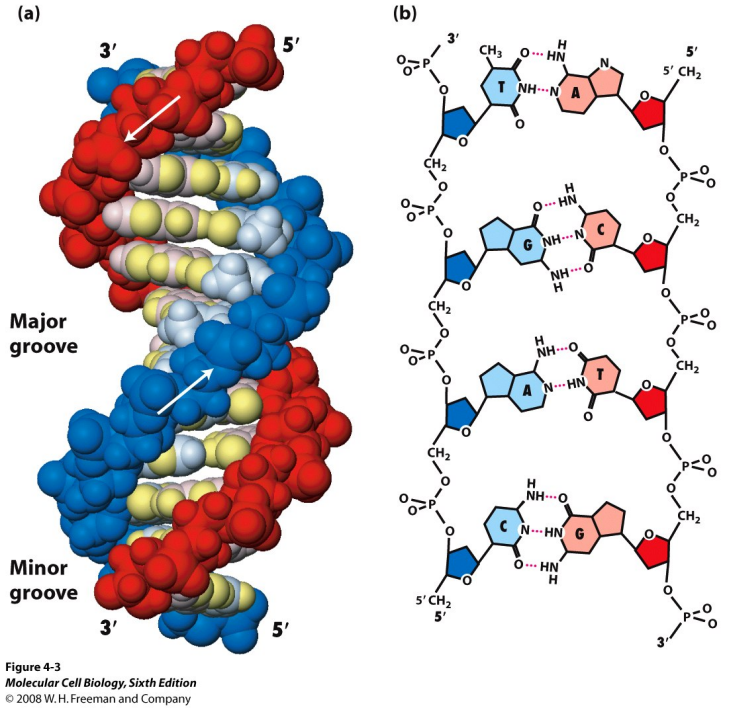

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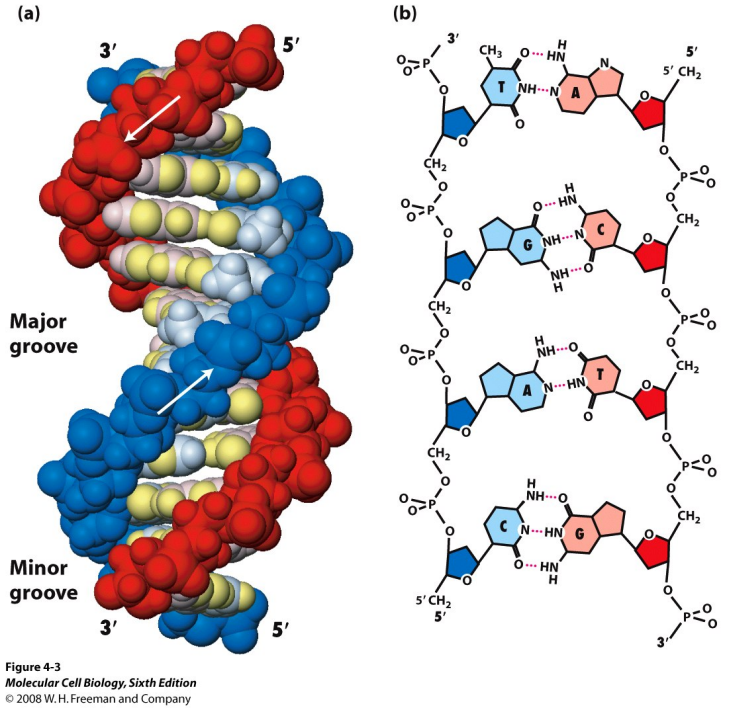

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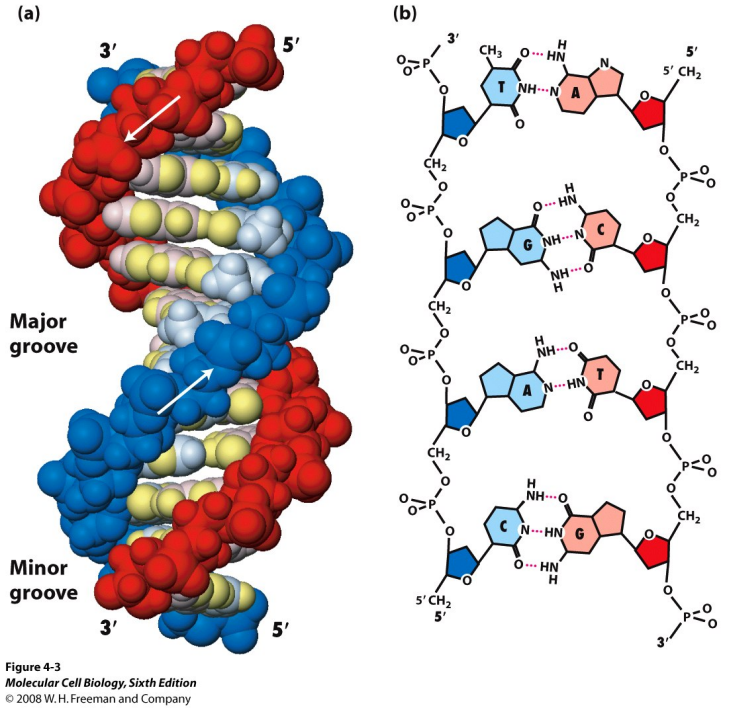

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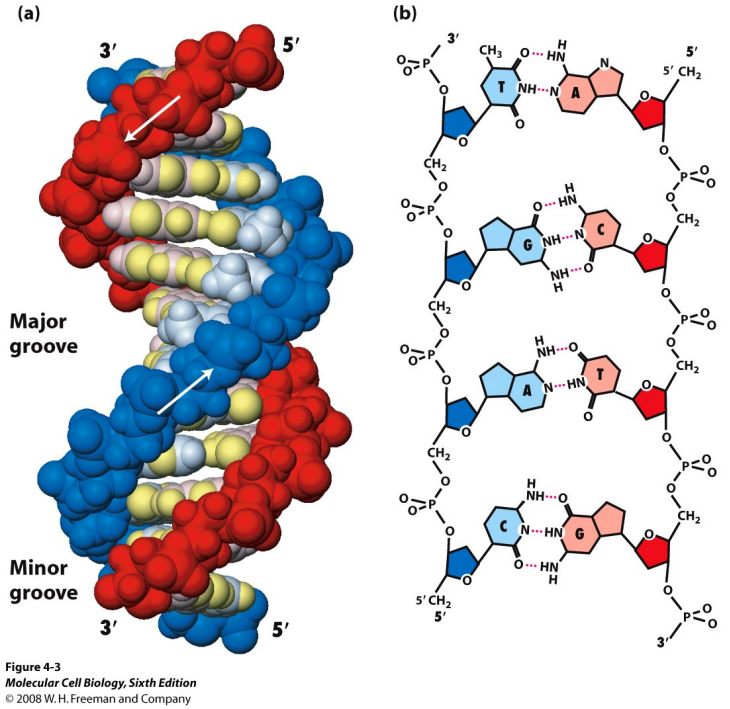
- Polarity:
  - 5’end = P-5’C on sugar
  - 3’end = 3’OH on sugar
- Base order along the polymer
- 3’ is the last base added (any new incoming base will be added to 3’OH)



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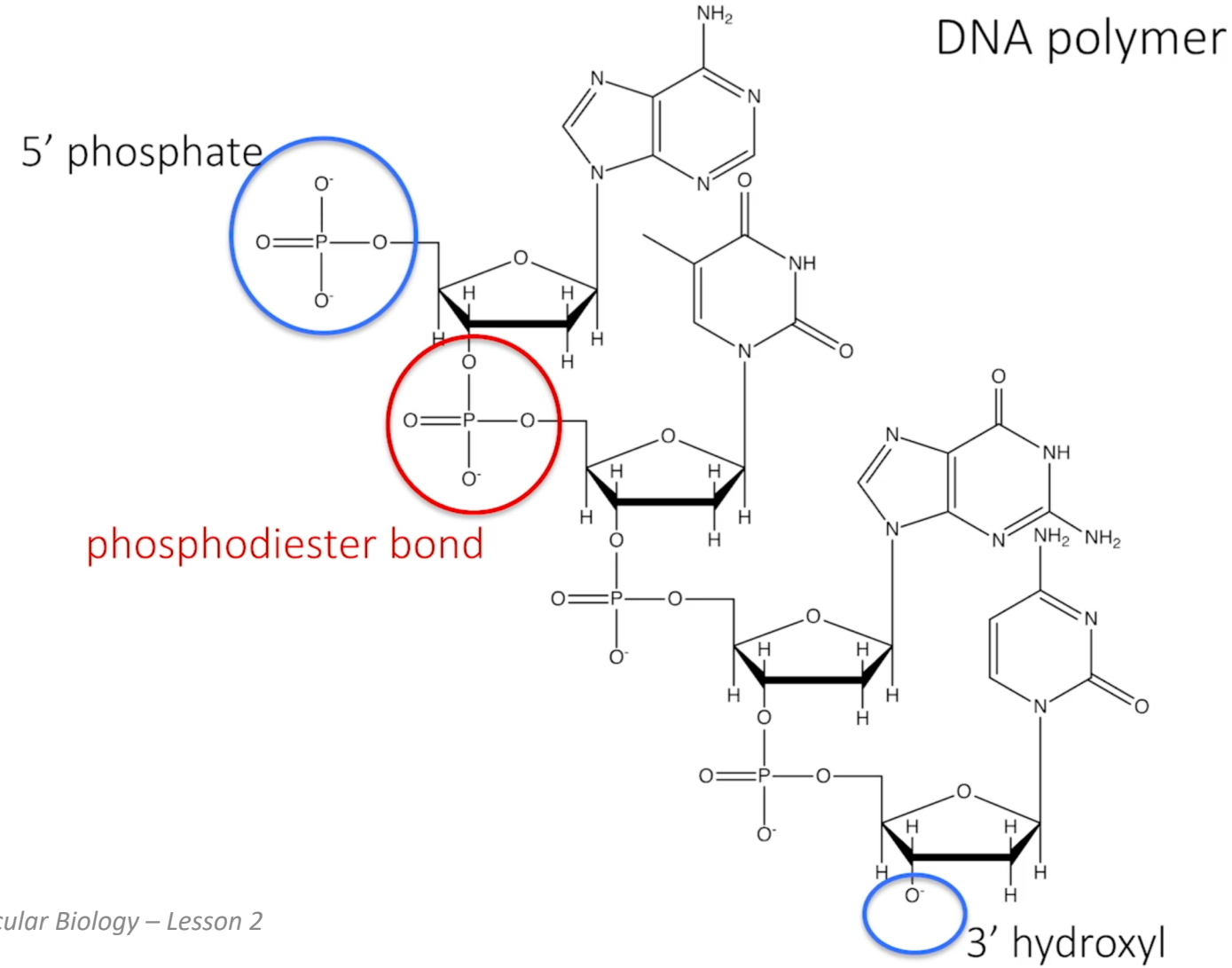
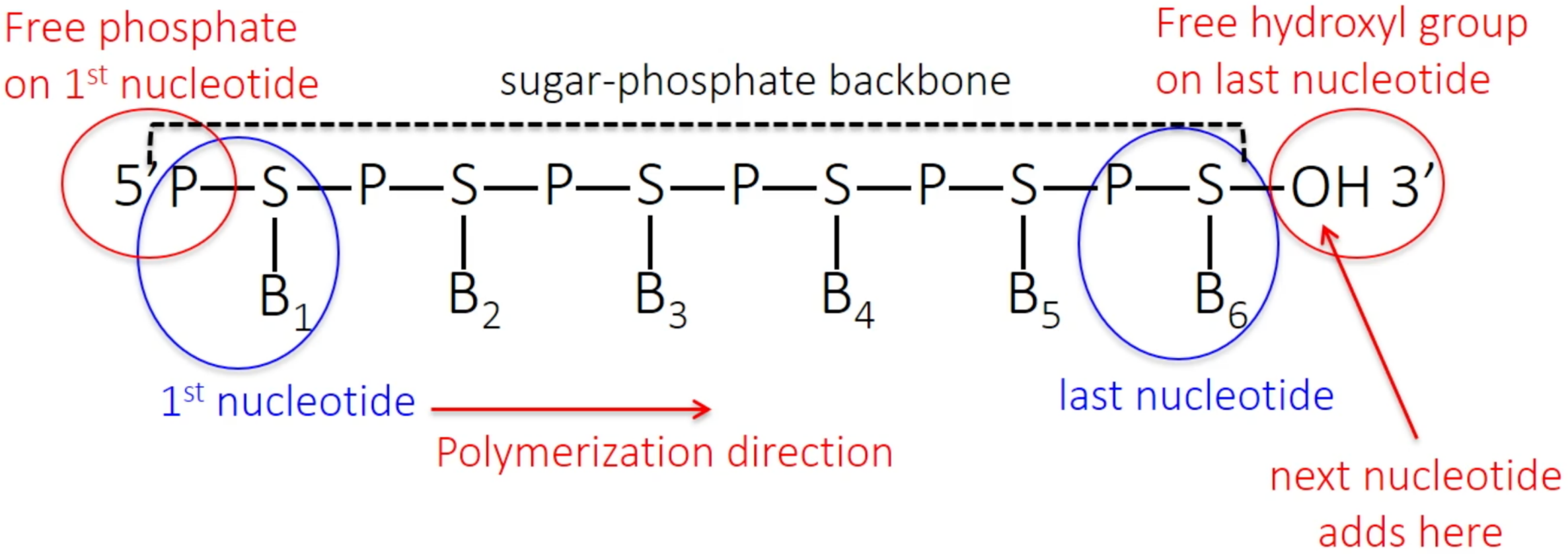


Nucleic acids

Nucleic acid polymer: direction and information



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- **ALWAYS write 5’ and 3’ on each nucleic acid strand**

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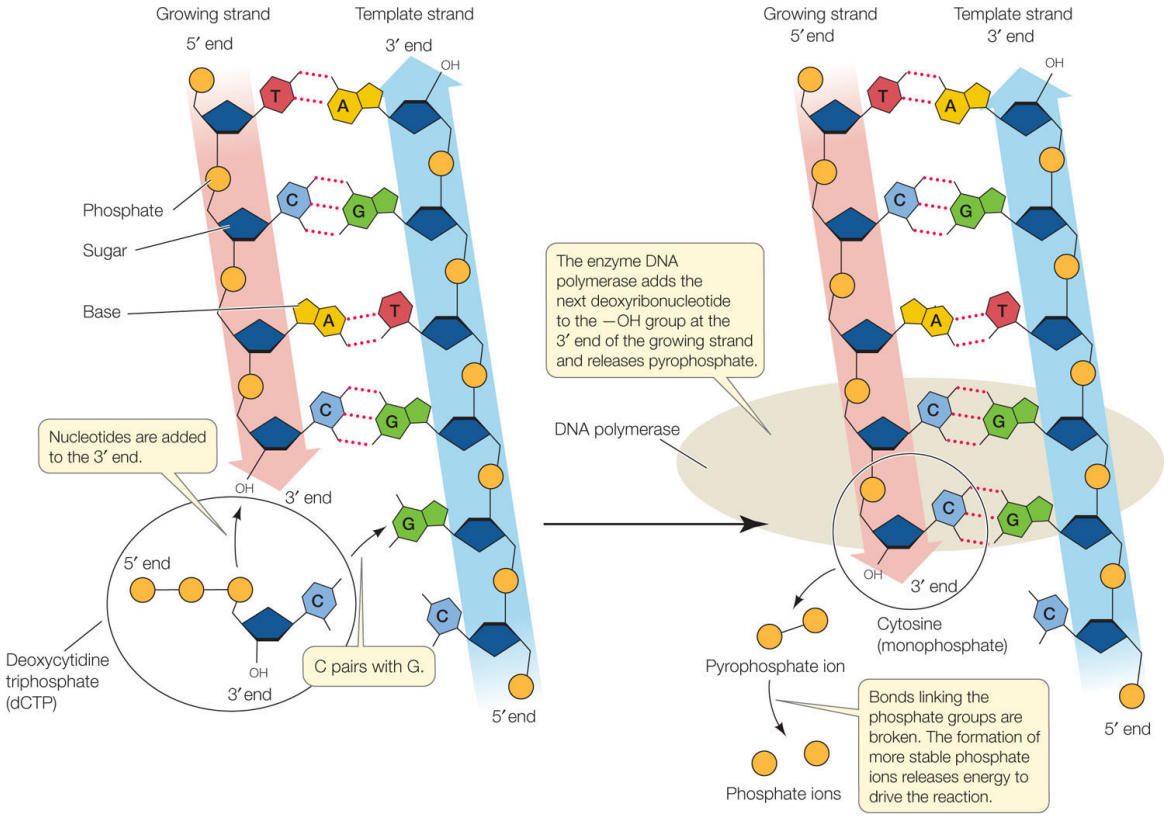
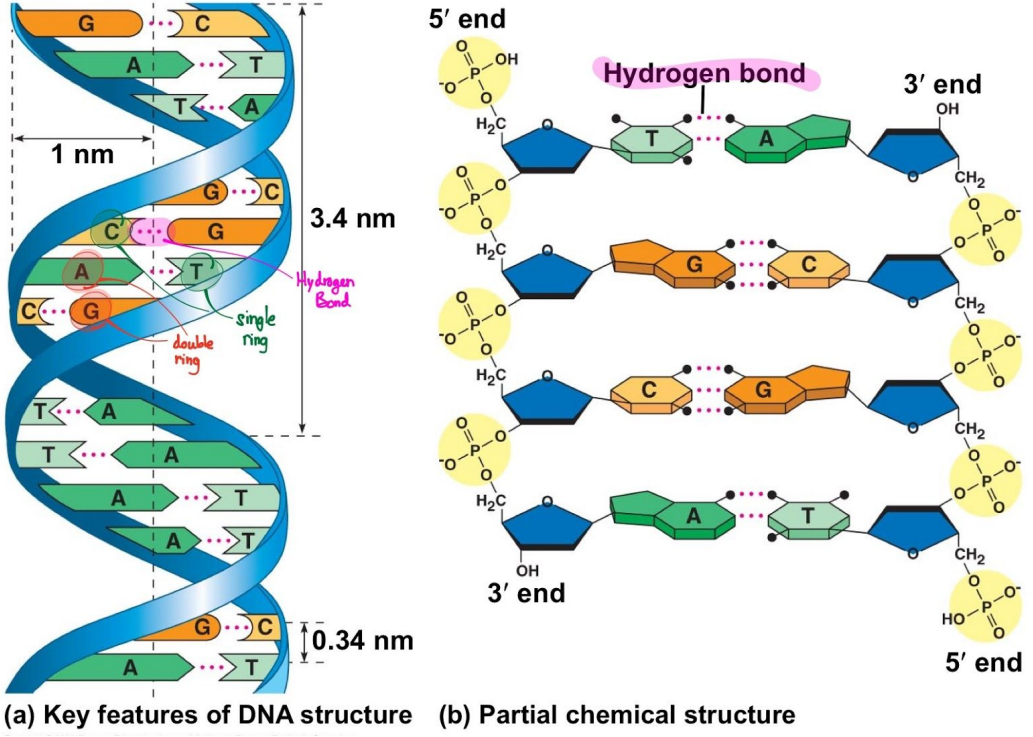
  $5'B_1B_2B_3B_4B_5B_6 3' = 5'GAATCC3'$

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



DNA structure

- DNA has a double-helix (DH) structure
  - 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 (helical pitch)



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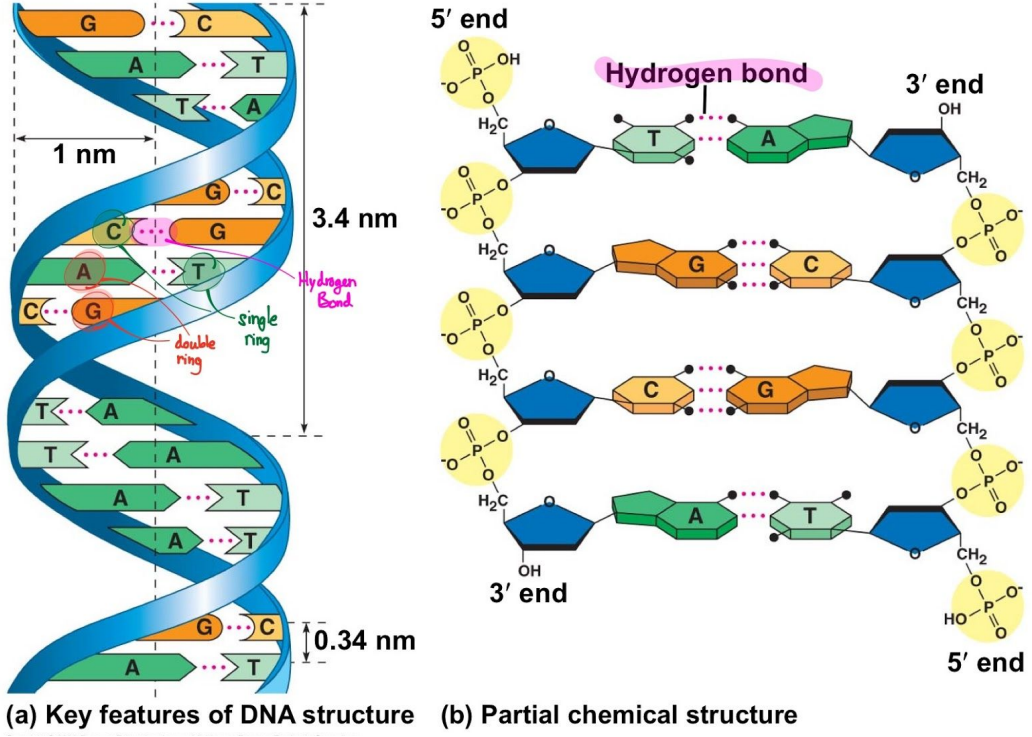
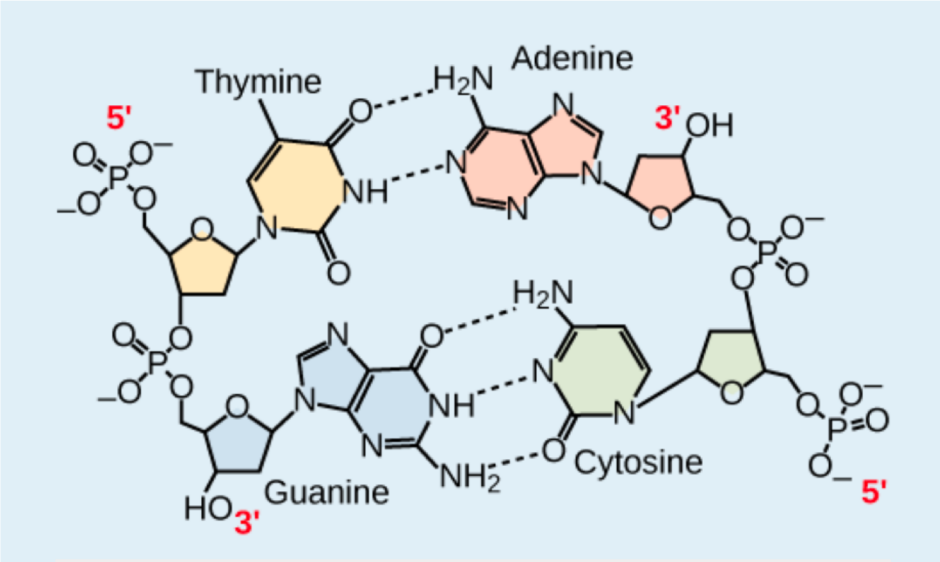
    - Every BP in the DH is separated from the next base pair by 0.34 nm (helical pitch)
- The two strands of the helix run in opposite directions, meaning that the 5′ carbon end of one strand will face the 3′ carbon end of its matching strand
  - This is referred to as **antiparallel orientation**
    - **Key DNA PROPERTY** (for DNA replication and in many nucleic acid interactions)



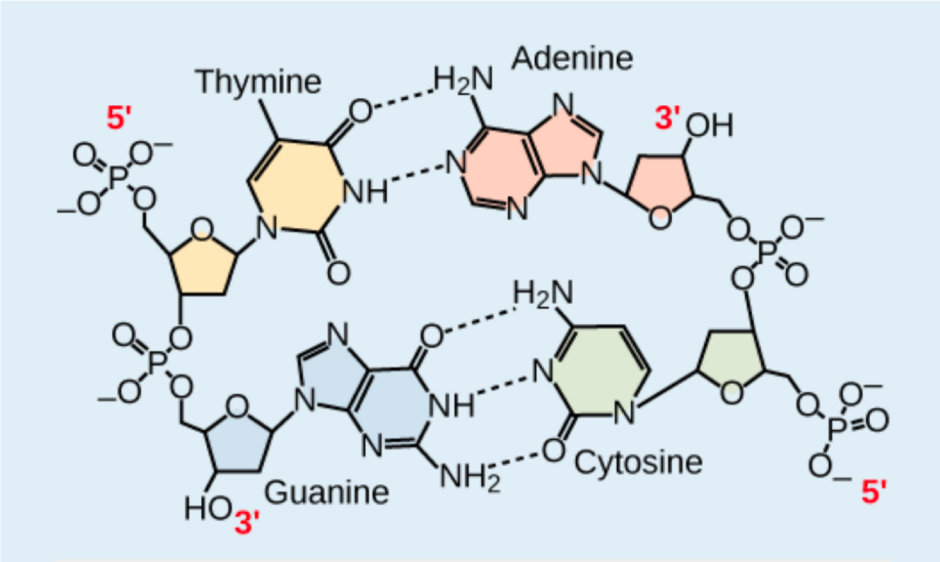
DNA structure

- Only certain types of base pairing are allowed:
- Specifically: A can only pair with T and G can only pair with C (**base complementary rule**)



DNA structure

- Only certain types of base pairing are allowed:
- 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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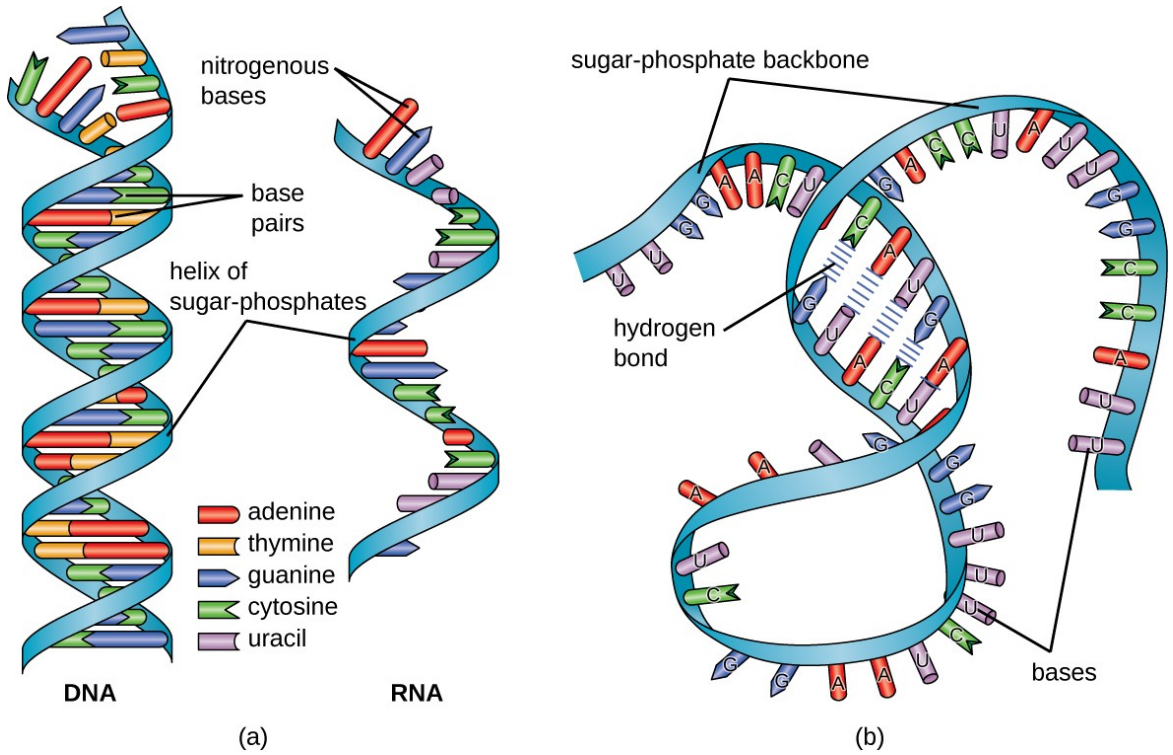

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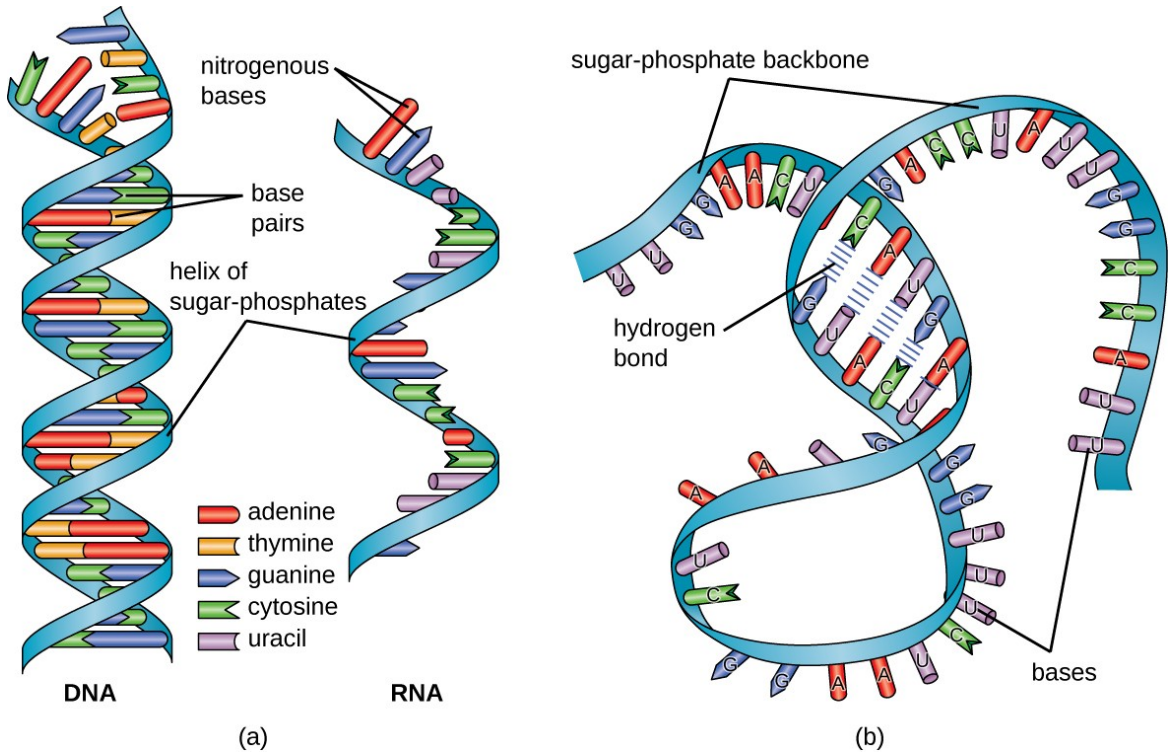
- The RNA four nitrogenous bases are A, **U**, G, and C
- There are four major types of RNA
  - messenger RNA (mRNA), ribosomal RNA (rRNA), transfer RNA (tRNA), and microRNA (miRNA) (more later)



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- The mRNA carries the message from DNA
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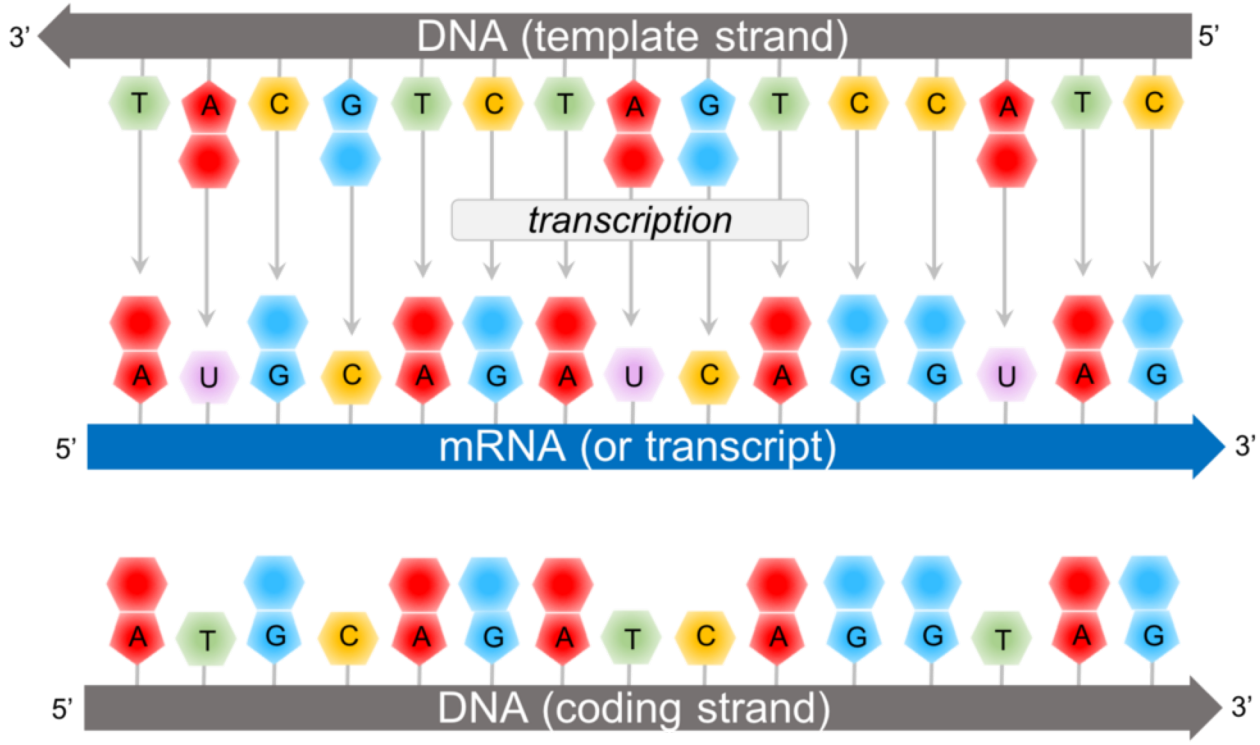
  - If a cell requires a certain protein to be synthesized, the gene for this product is "turned on" and the messenger RNA is synthesized in the cellular nucleus (more later in the course)
- **The RNA base sequence is complementary to the coding sequence of the DNA which it has been copied from but**
- If the DNA strand has a sequence **5'AATTGCGC3'**, the sequence of the complementary RNA strand is **5'UUAACGCG3'**



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