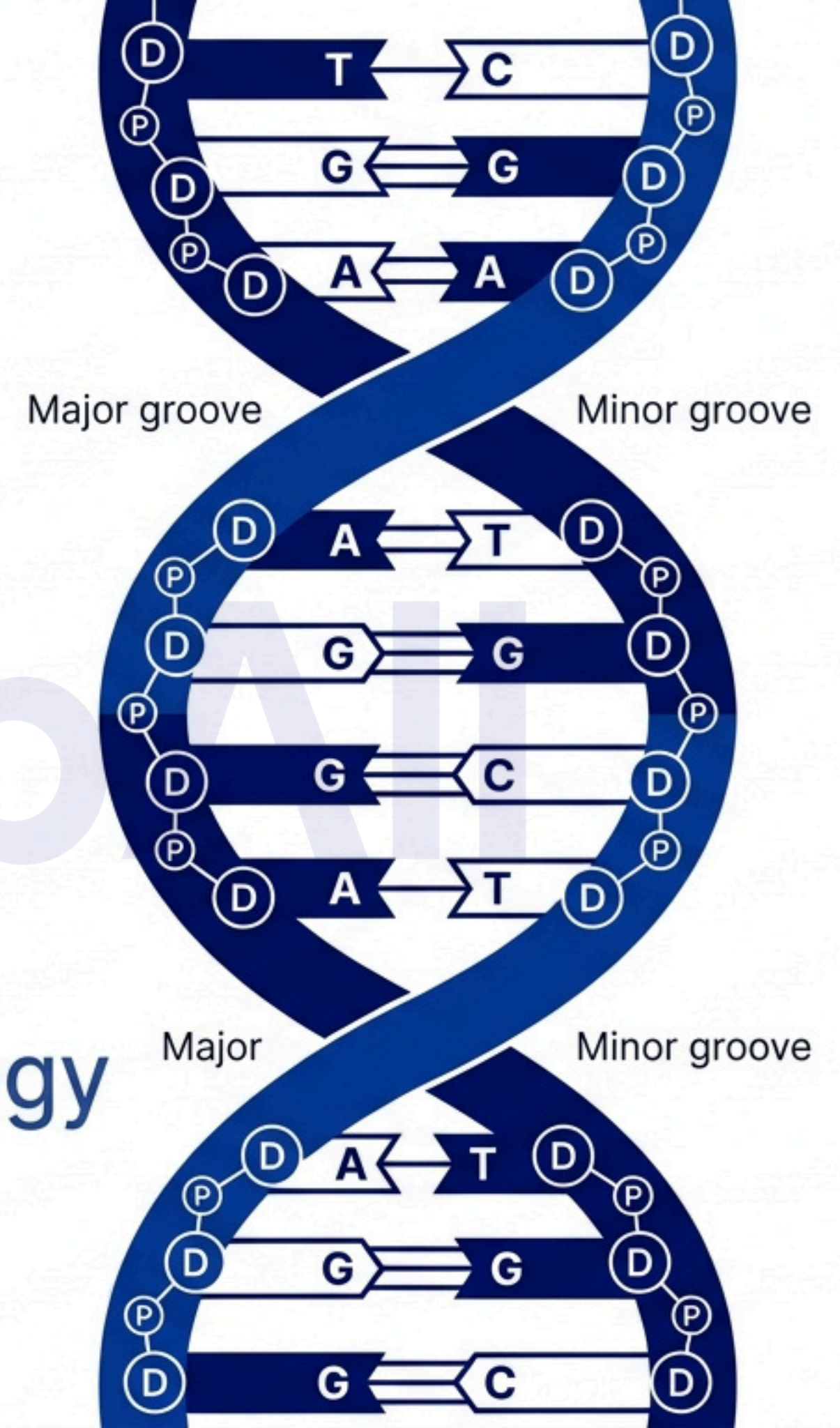


Visual Summary & High-Yield NEET Diagnostics

DNA Double Helix

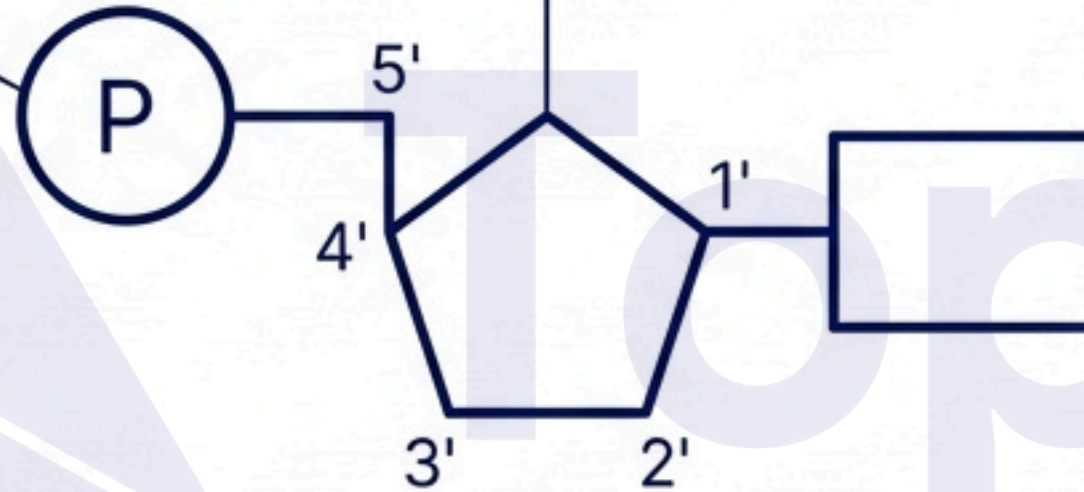
The Structural Blueprint and Central Dogma of Molecular Biology



Nucleotide Anatomy

Phosphate Group

Attached to the 5' carbon of the sugar. Forms the backbone via phosphodiester linkages.



Deoxyribose Sugar

A 5-carbon pentose sugar. Lacks an oxygen at the 2' position compared to RNA.

Nitrogenous Base

Linked to the 1' carbon of the sugar via an N-glycosidic linkage.



Quick Tip: Exams often test linkage types: N-glycosidic for base-to-sugar, Phosphodiester for nucleotide-to-nucleotide.

The Code Logic: Erwin Chargaff's Rule

For any double-stranded DNA, the ratios between Adenine (A) and Thymine (T), and Guanine (G) and Cytosine (C) are constant and equal one.



$$[A] + [G] = [T] + [C]$$



Caution: Chargaff's rule ONLY applies to double-stranded nucleic acids. Do not apply this to single-stranded RNA or ssDNA!

Base Pairing Diagnostic Matrix

	Purines (Double Ring)	Pyrimidines (Single Ring)
2 Hydrogen Bonds	Adenine (A) <chem>Nc1ncnc2n(cnc12)[nH]</chem>	Thymine (T) <chem>CC1=CNC(=O)NC1=O</chem>
3 Hydrogen Bonds	Guanine (G) <chem>Nc1nc2[nH]cnc2c(=O)[nH]1</chem>	Cytosine (C) <chem>Nc1cc[nH]c(=O)n1</chem>

💡 Quick Tip: Structural Rule: Always a Purine opposite a Pyrimidine. This generates an approximately uniform distance between the two strands of the helix.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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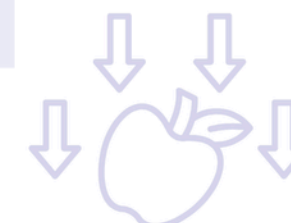
Practice Now



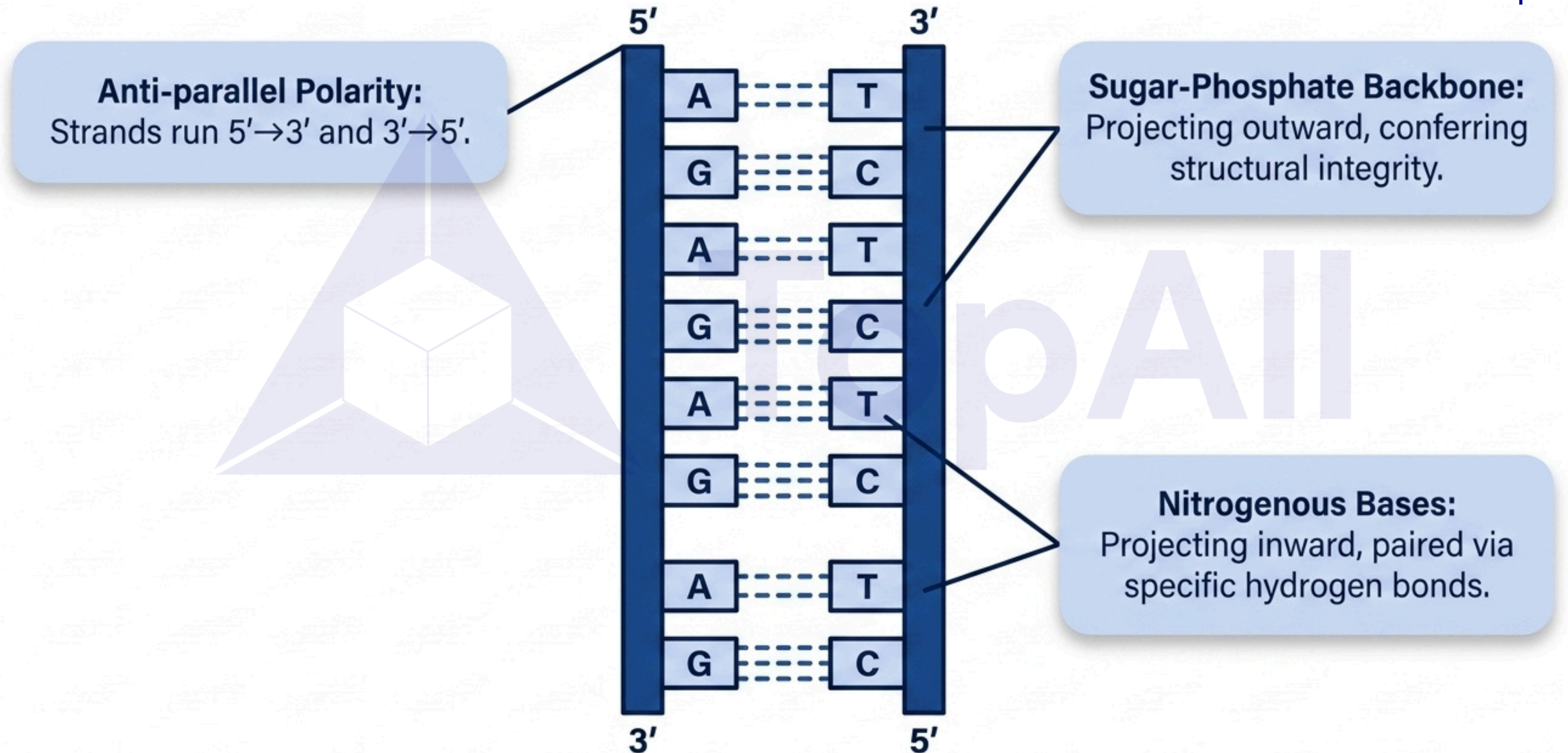
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Key Highlights

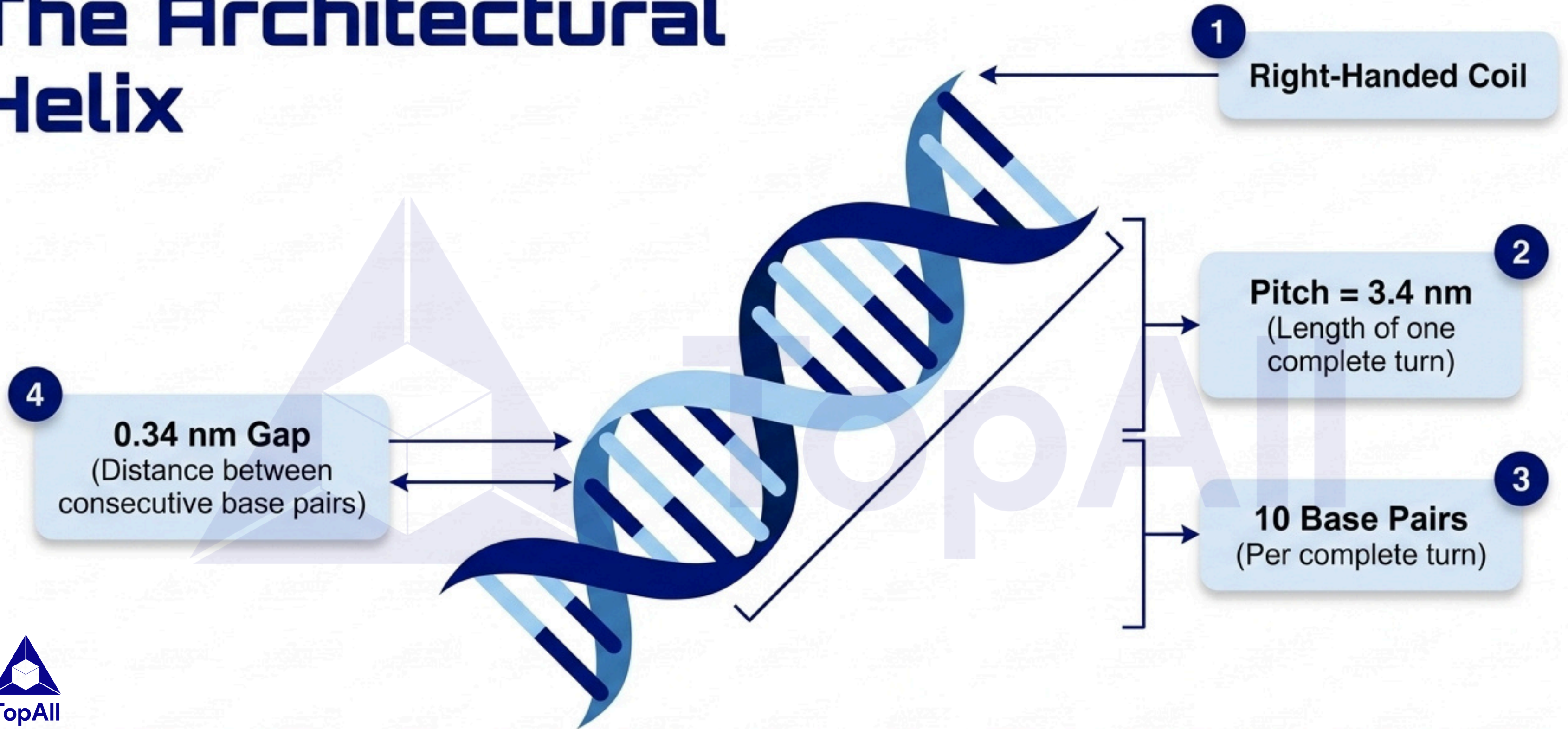
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The 2D Schematic

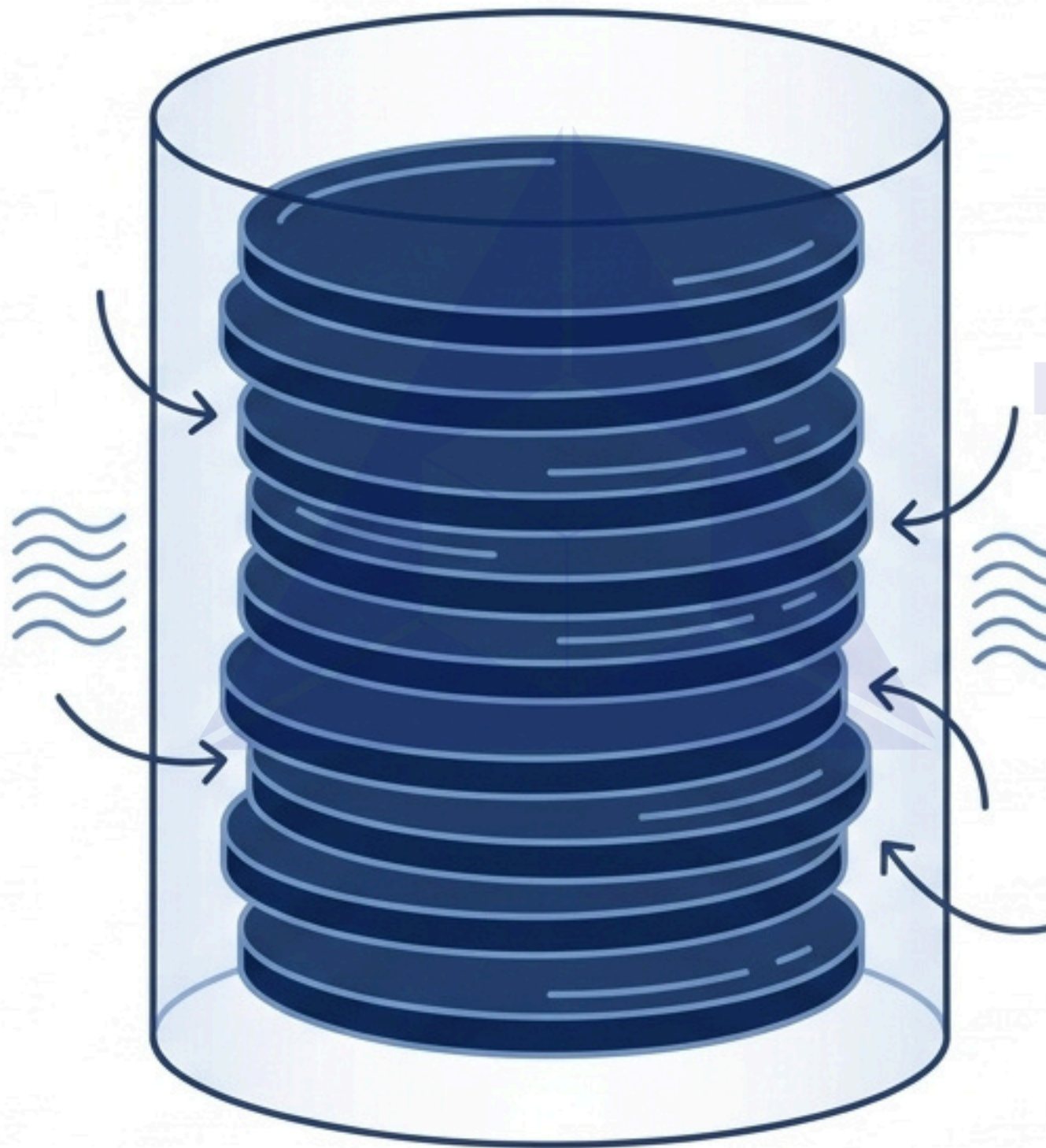


The Architectural Helix



Proposed in 1953 by James Watson and Francis Crick, utilizing X-ray diffraction data from Maurice Wilkins and Rosalind Franklin.

The Architecture of Stability



Base Stacking



The plane of one base pair stacks over the other in the double helix. Like a stack of coins, this minimizes water contact and maximizes hydrophobic interactions.

Hydrogen Bonds



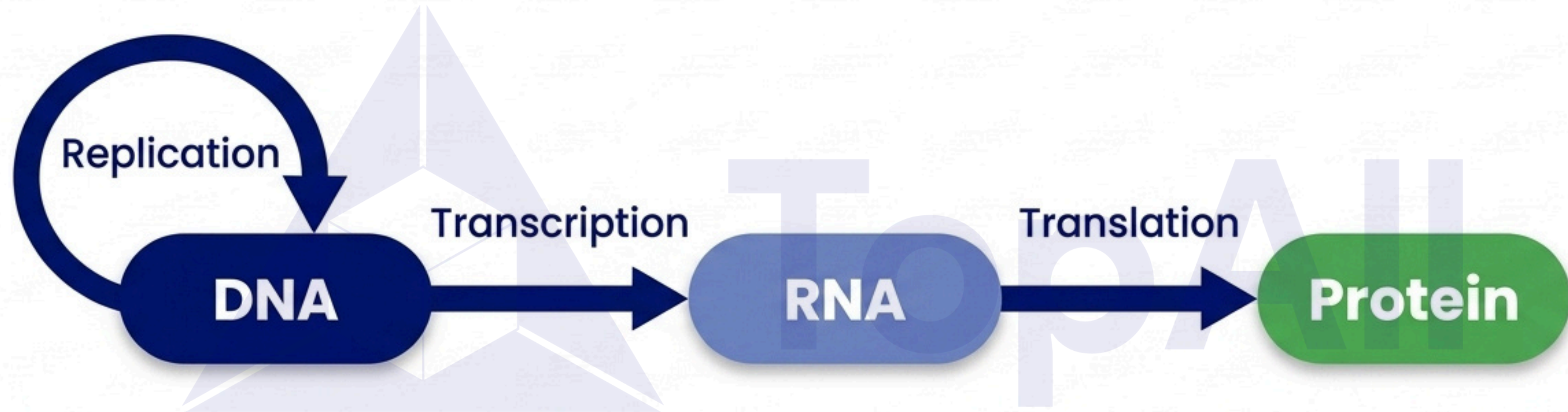
While individual H-bonds are weak, thousands of them in sequence act like a molecular zipper, locking the two strands together.

Exam tip: Helical stability is conferred by BOTH H-bonds AND base stacking, not just H-bonds alone.



The Central Dogma of Molecular Biology

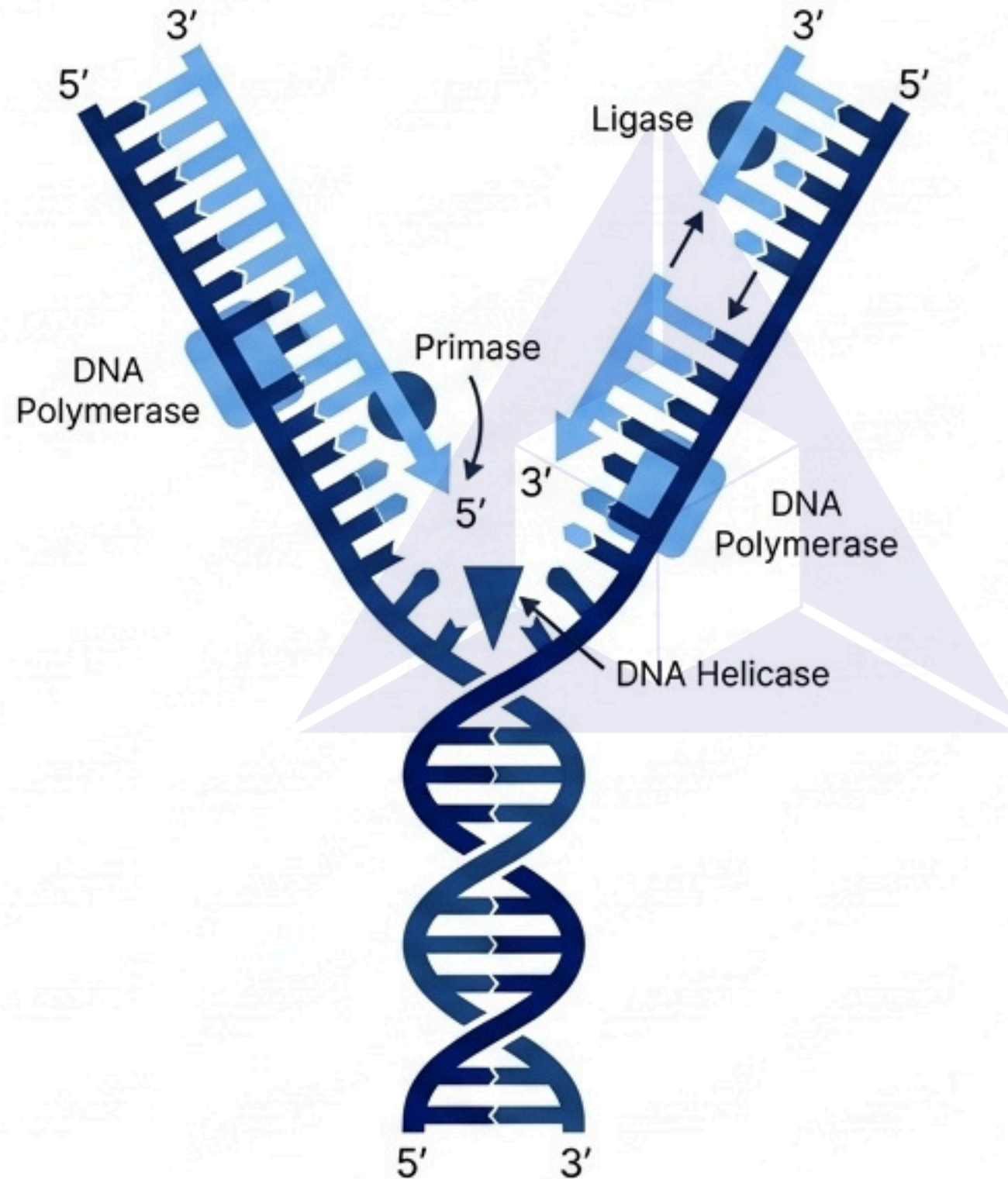
Proposed by Francis Crick, the Central Dogma dictates the unidirectional flow of genetic information in living systems.



Mistake

Fundamental Rule: Information flows DNA → RNA → Protein. It cannot naturally flow backward from Protein to RNA or DNA.

Phase 1: Replication (DNA → DNA)

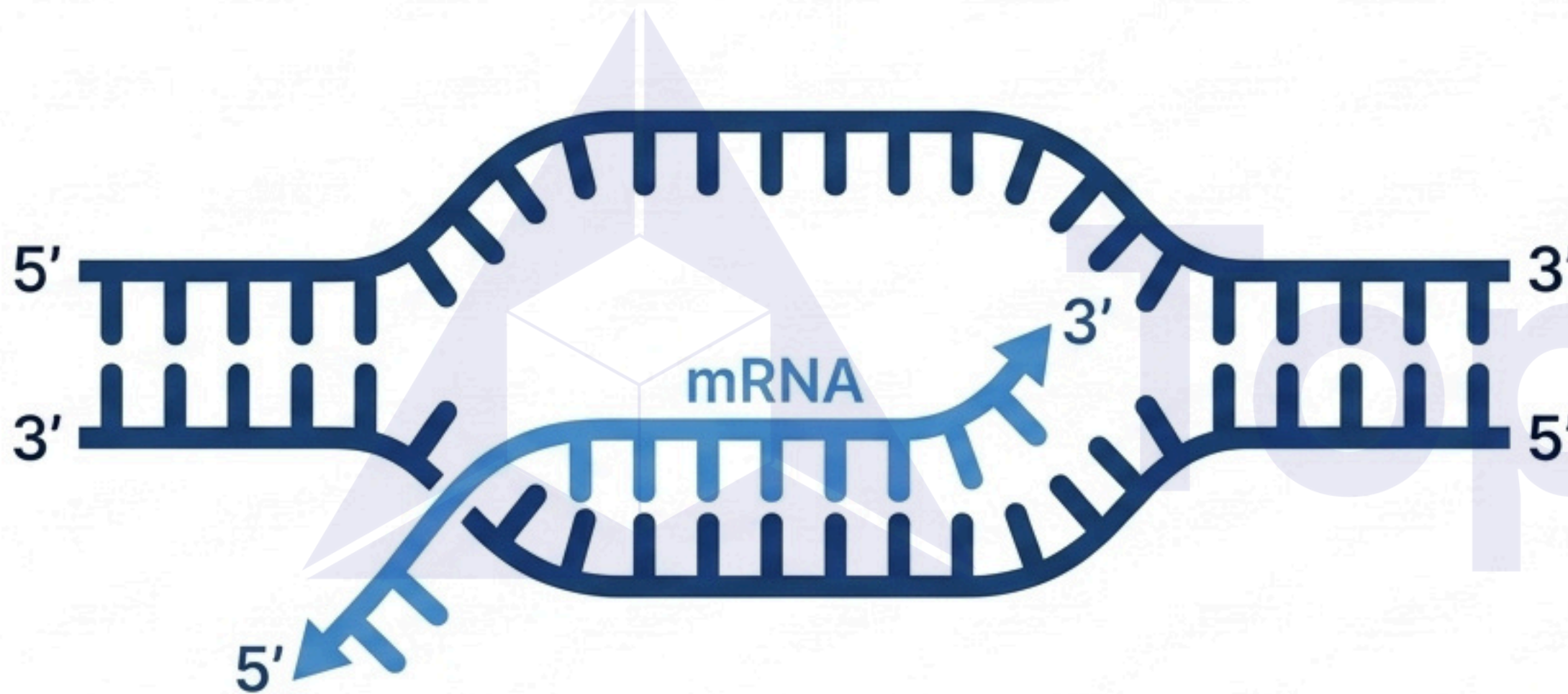


Semiconservative Mechanism

Because of base pairing complementarity, each parental strand acts as a perfect template.

- ✓ The two strands separate.
- ✓ New complementary strands are synthesized.
- ✓ Result: Two identical daughter molecules, each with one old and one new strand.

Phase 2: Transcription (DNA → RNA)



The Template

Only one strand of DNA (polarity 3'→5') acts as the **template**.

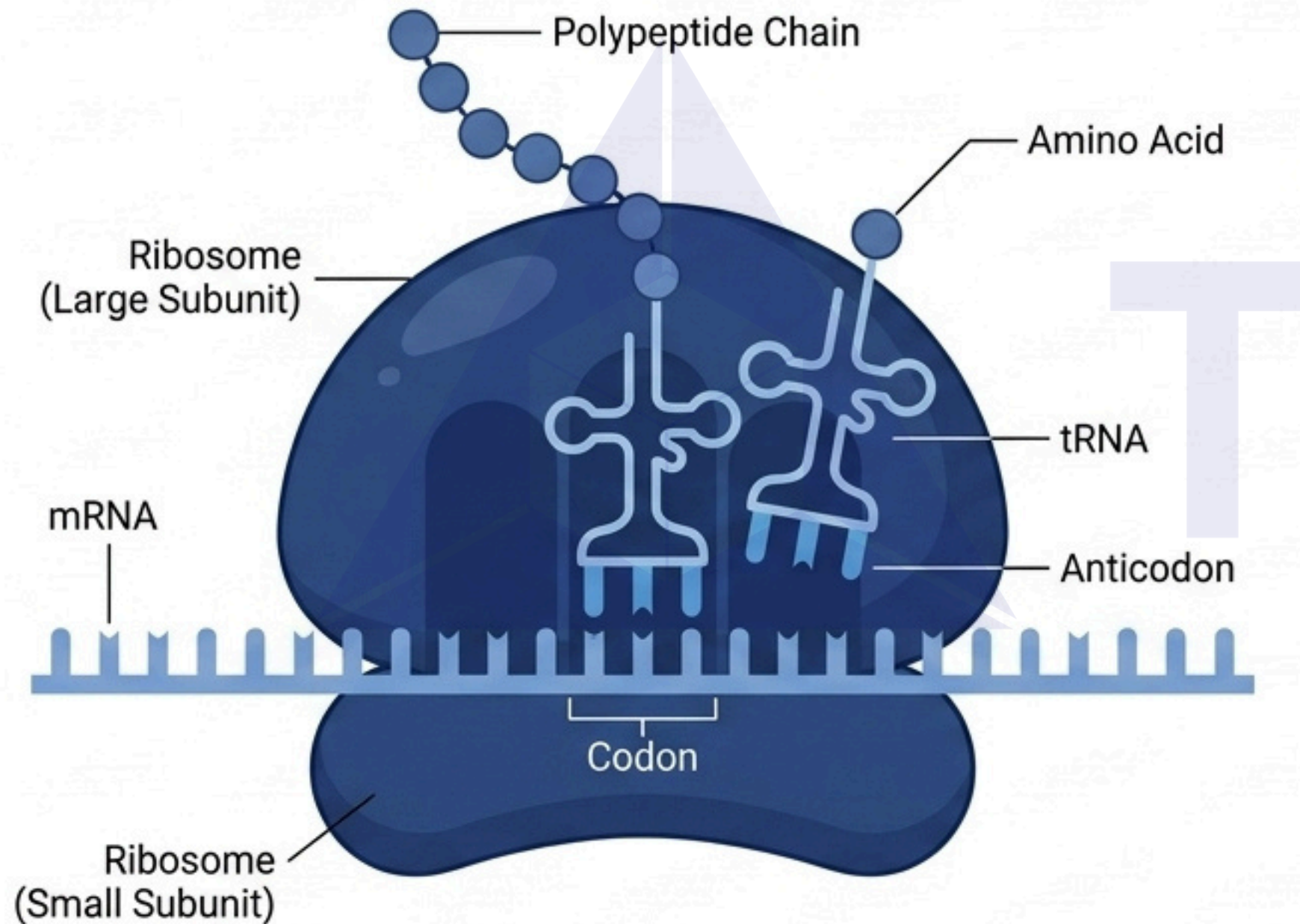
The Language Shift

The principle of **complementarity** remains, but with one critical chemical swap.

Quick-Tip

Adenine now pairs with Uracil (U) instead of Thymine (T) in the RNA transcript.

Phase 3: Translation (RNA → Protein)



The Problem

No **physical complementarity** exists between nucleic acids and amino acids.

The Solution: tRNA

An **adapter molecule** that reads the mRNA code on one end (anticodon loop) and binds a specific amino acid on the other (acceptor end).

The Factory: Ribosome

Acts as both the **staging ground** and the **catalyst** (ribozyme) for forming peptide bonds between amino acids.

Key Takeaway: Structure Dictates Destiny

Structural Feature:
Double-stranded &
H-bonded.

Biological Function:
Allows strands to
separate and act as
templates for
Replication.

Structural Feature:
Base-pairing rules
(A-U, G-C).

Biological Function:
Allows precise
copying into mRNA
during Transcription.

Structural Feature:
Linear sequence of
triplets.

Biological Function:
Provides the code
read by tRNA
adapters during
Translation.

The elegant simplicity of the Watson-Crick model immediately revealed the copying mechanism for all genetic material.



You've Learned the Theory.

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