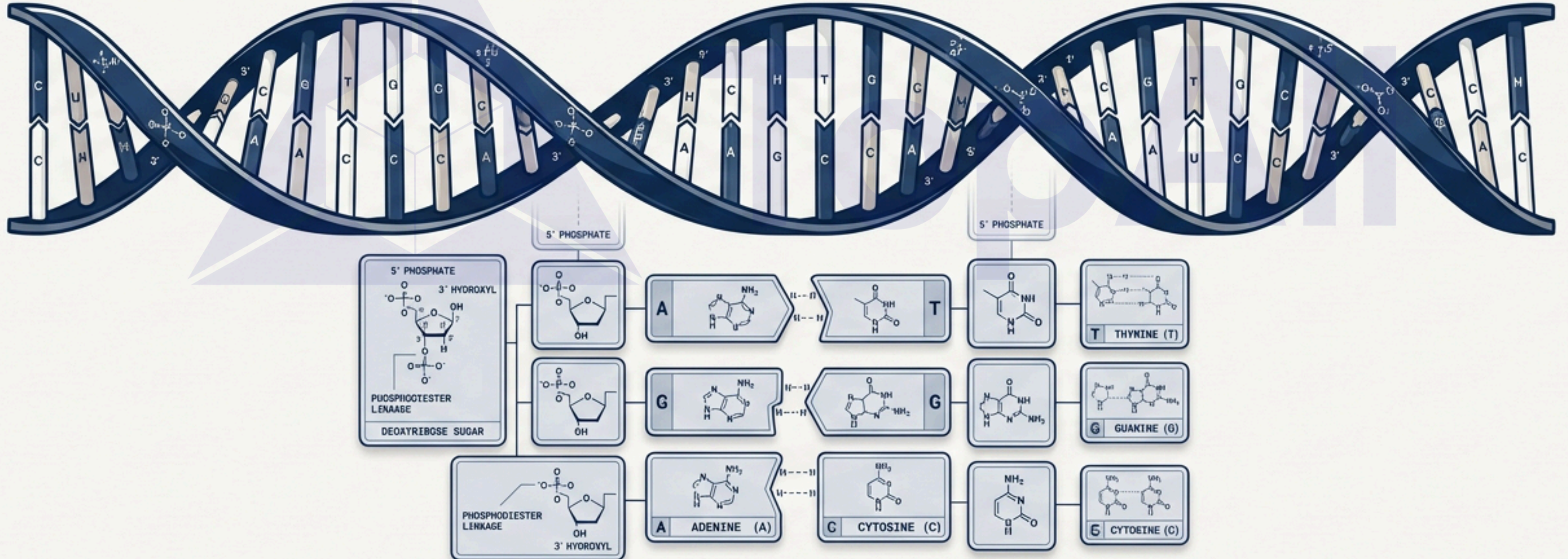


Structure of Nucleic Acids

The molecular architecture of DNA and RNA: from foundational nucleotides to the double helix.

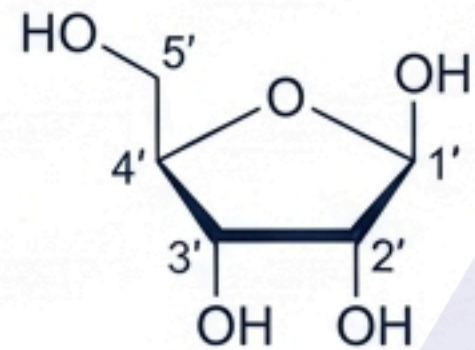


1. THE FIRST BUILDING BLOCK

Forming the Nucleoside

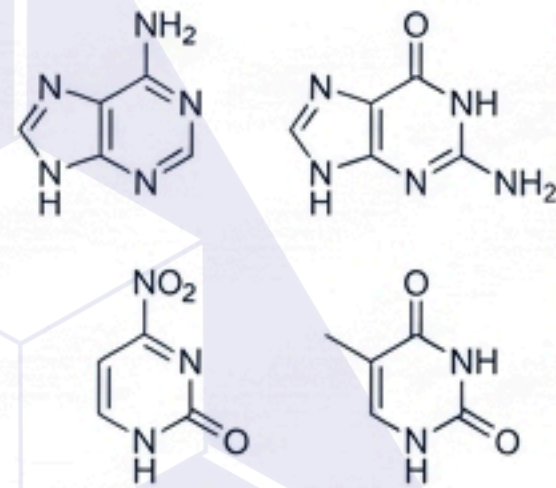
Card 1: The Components

Pentose Sugar



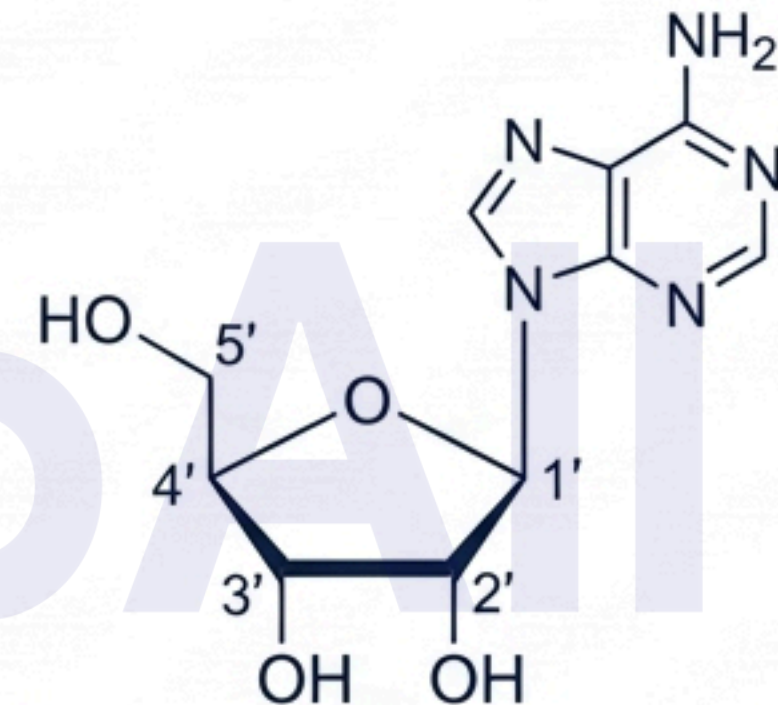
β -D-ribose (RNA) or
 β -D-2-deoxyribose (DNA)

Nitrogenous Base



Purines (A, G) or
Pyrimidines (C, T, U)

Card 2: The Assembly



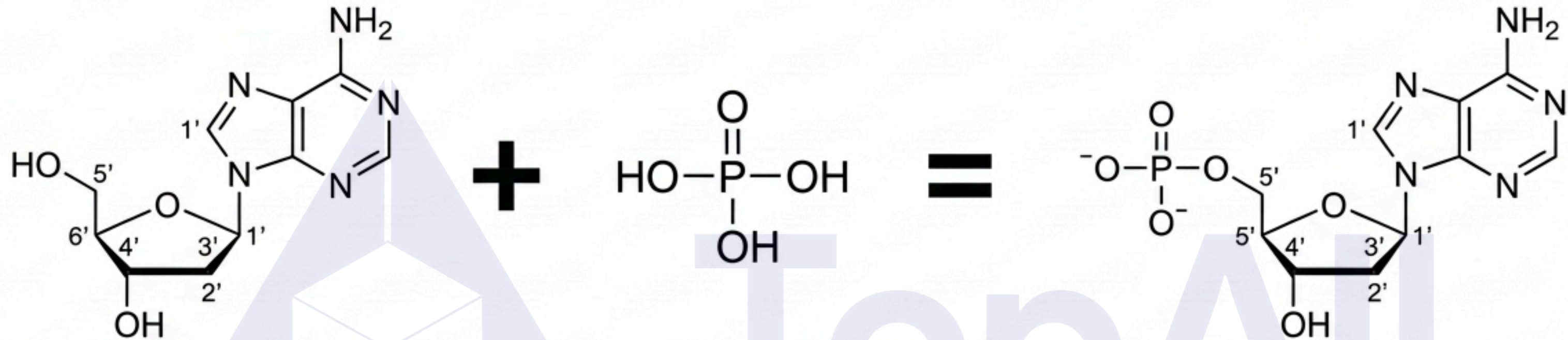
Blueprint Strip

Sugar Carbon Numbering: 1', 2', 3', 4', 5'

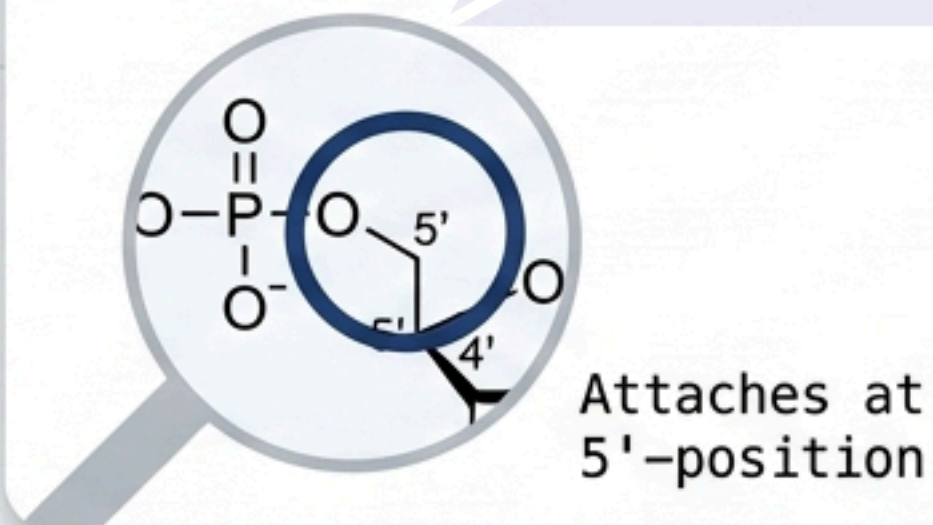
Base attaches exactly at the 1' position.
Primed numbers distinguish sugar
carbons from base carbons.

RECAP: A Nucleoside is purely a sugar bonded to a base at the 1' carbon. No phosphate is present yet.

Forming the Nucleotide



Attachment Point Zoom



The Equation

Nucleoside + Phosphoric Acid = Nucleotide



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$$E=mc^2$$



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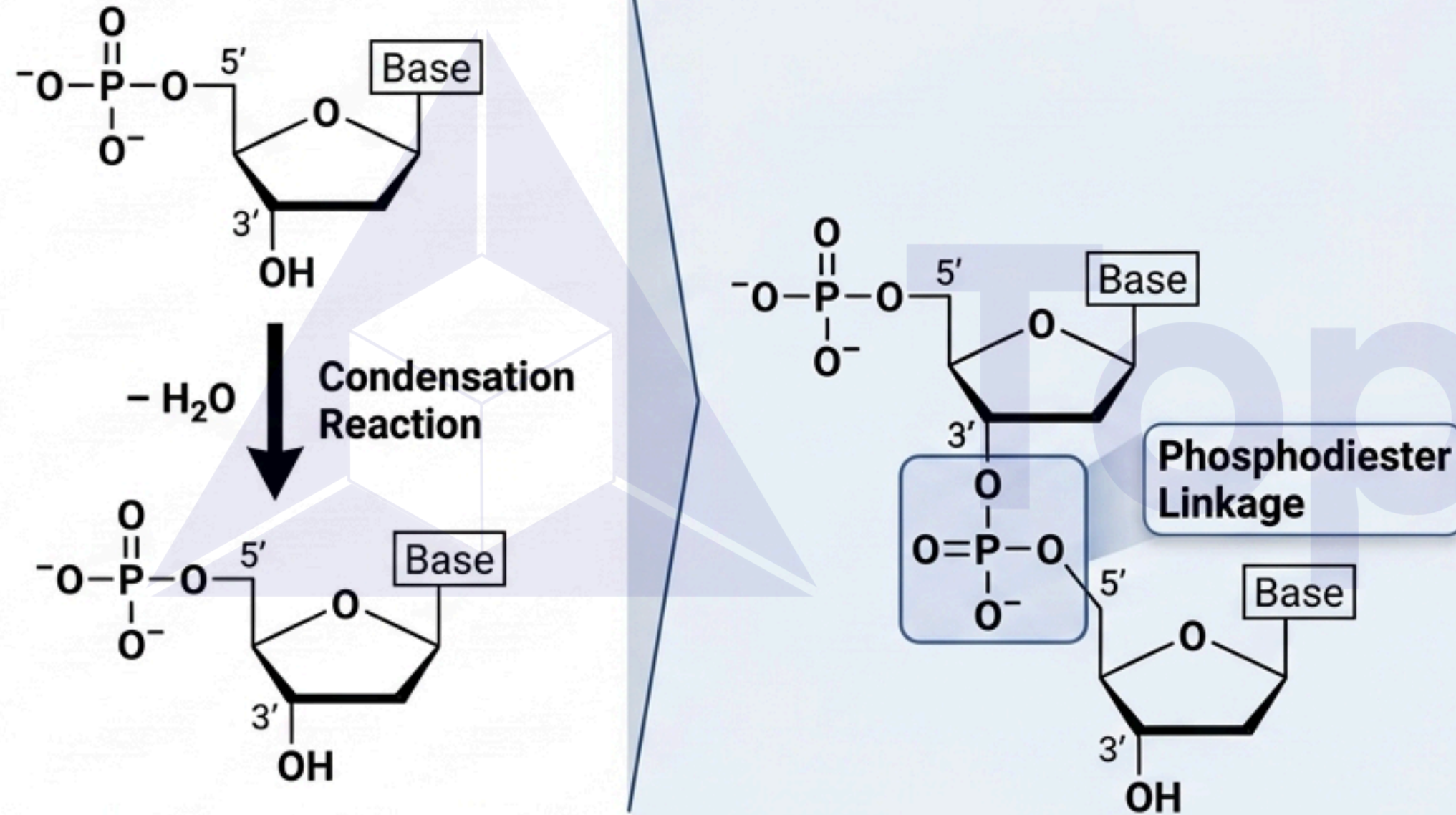
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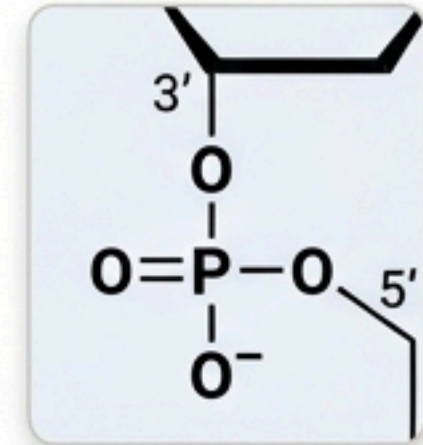


3. CONNECTING THE MONOMERS

The Phosphodiester Linkage



The Bridge

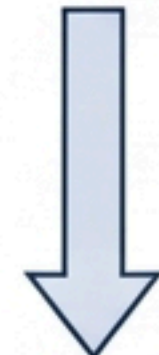


The phosphate group of one nucleotide connects to the 3' carbon of the next pentose sugar.

Directionality

[5' End]

(free phosphate)



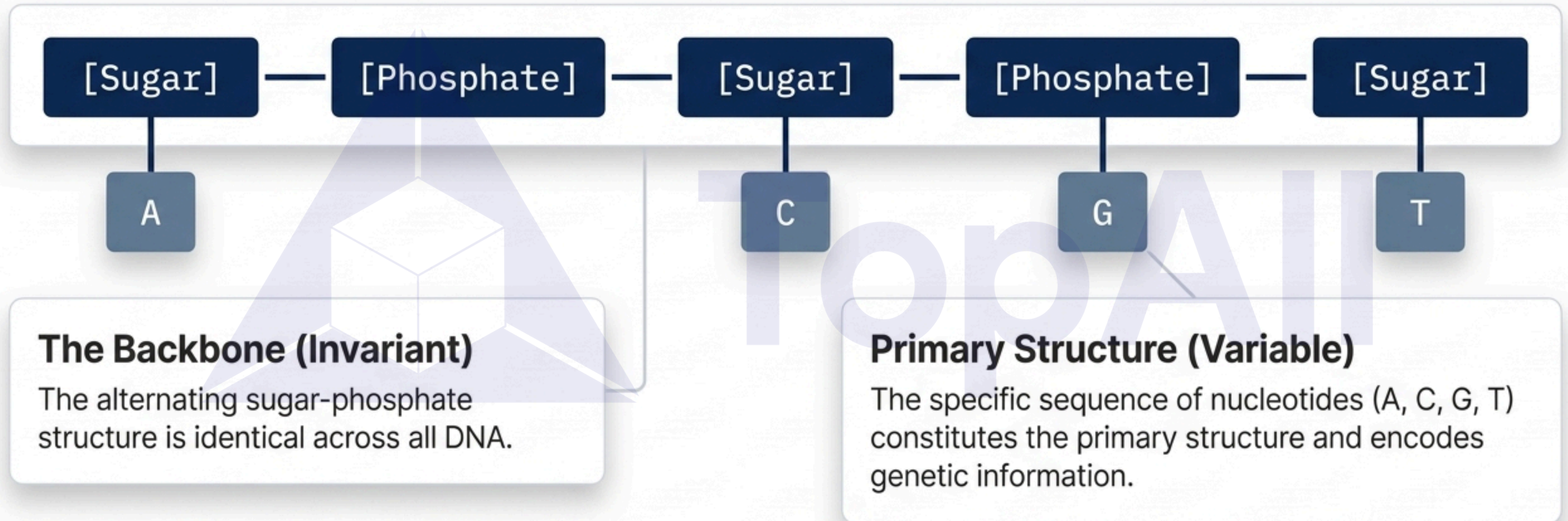
[3' End]

(free hydroxyl)

RECAP: Nucleotides are joined by phosphodiester linkages specifically between the 5' and 3' carbon atoms of adjacent pentose sugars.

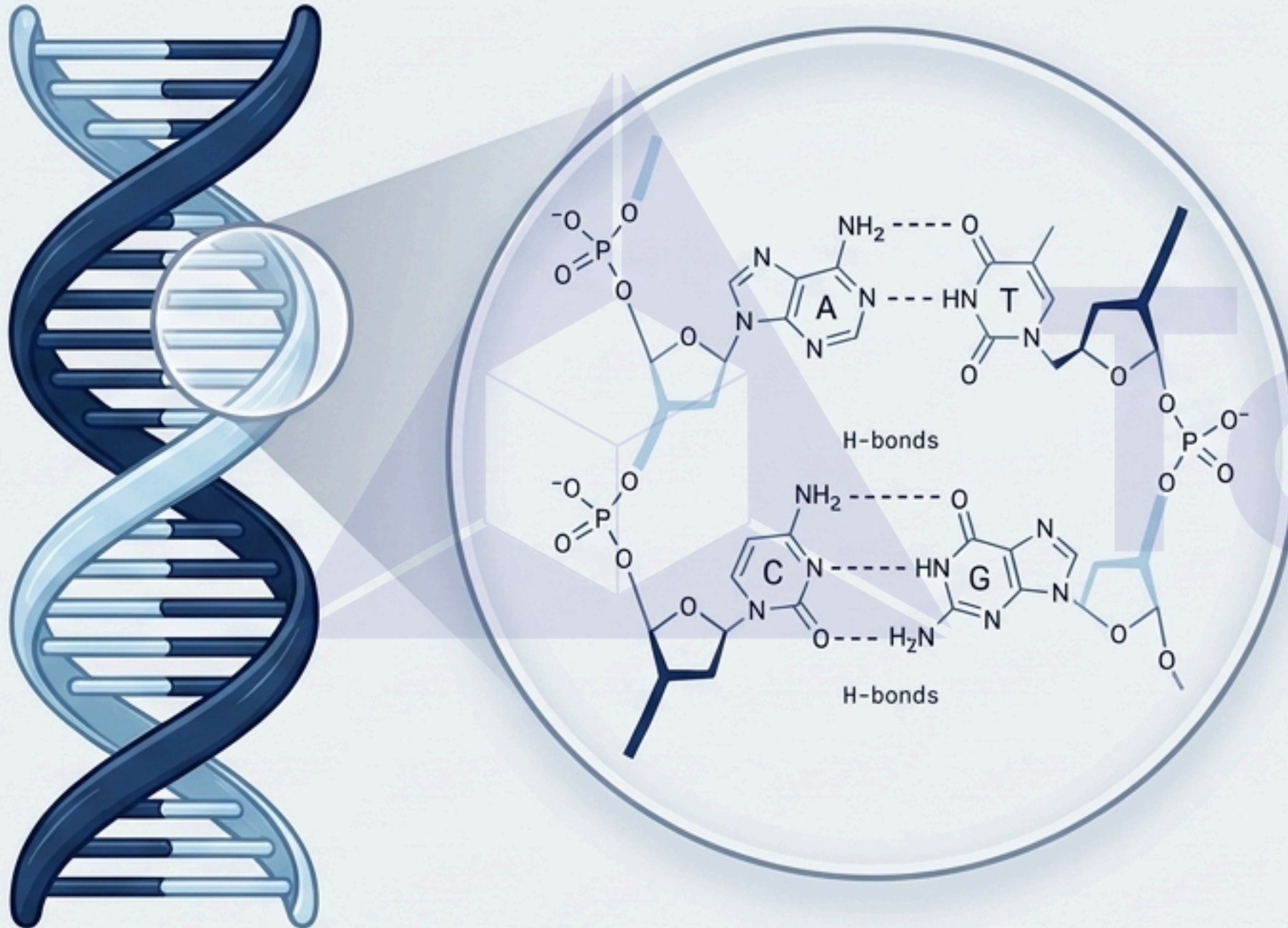
4. PRIMARY STRUCTURE

The Polynucleotide Backbone



RECAP: A polynucleotide is a long chain of repeating sugar-phosphate units carrying a variable sequence of bases.

The Watson-Crick Double Helix



The Helix

Two complementary nucleic acid chains wound around each other in anti-parallel directions.

Complementary Pairing

Adenine (A) = Thymine (T)
Cytosine (C) $\equiv$ Guanine (G)

The Bond

Strands are zipped together by specific hydrogen bonds between these base pairs.

DNA vs. RNA Strands

	DNA	RNA
Sugar	β -D-2-deoxyribose	β -D-ribose
Unique Base	Contains Thymine (T)	Contains Uracil (U)
Shared Bases	A, G, C	A, G, C
Secondary Structure	Double-stranded helix	Single-stranded helix, sometimes folded
Types / Function	One primary form, reserve of genetic info	Three distinct types: mRNA, rRNA, tRNA for protein synthesis

RECAP: Both are polynucleotides, but variations in the sugar and a single pyrimidine base result in drastically different macro-structures and biological roles.



You've Learned the Theory.

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