

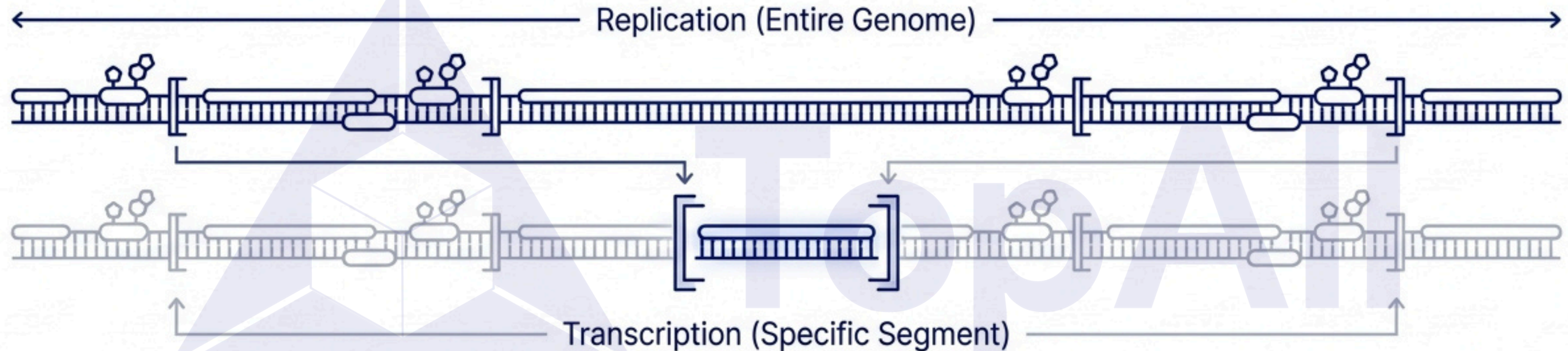
TopAll

The Transcription Unit

Anatomy of the DNA Blueprint • Molecular Basis of Inheritance (5.5.1)

Transcription requires strict molecular boundaries

Unlike replication, which duplicates the entire genome, transcription only copies a specific segment of DNA and only one of its strands. This requires a clearly defined unit.



A Promoter

The Initiation Point. Defines where the machinery binds.

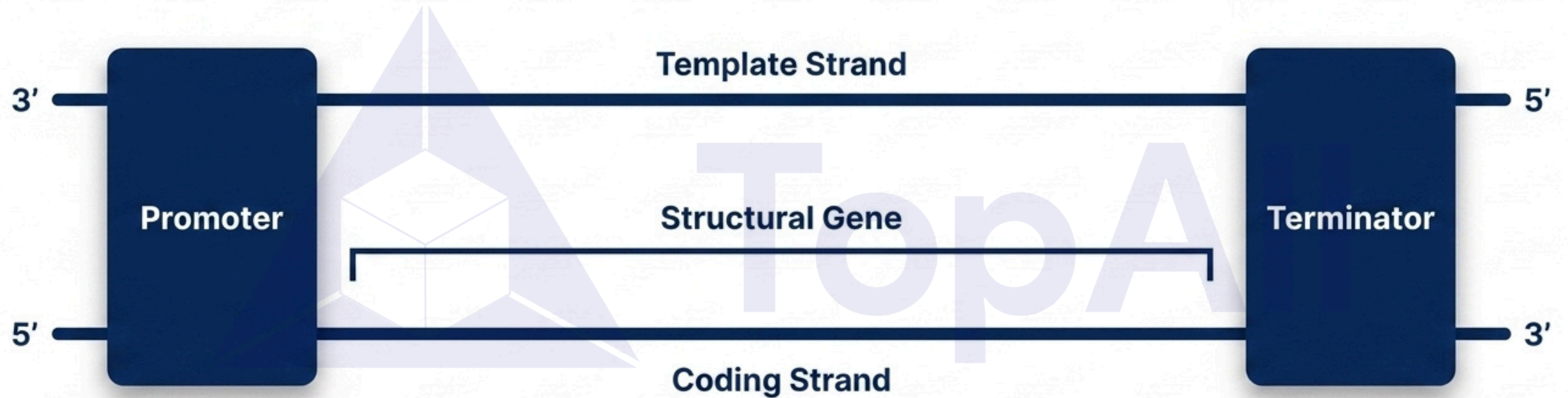
The Structural Gene

The Blueprint. The actual sequence to be transcribed.

A Terminator

The Endpoint. Signals the machinery to stop and detach.

The structural layout of a transcription unit





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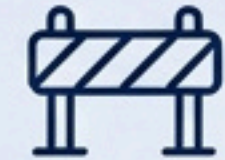


The Promoter and Terminator define the boundaries



The Promoter

- Provides the binding site for DNA-dependent RNA polymerase.
- Located upstream (towards the 5'-end of the coding strand).
- Its presence dictates which strand acts as the template.



The Terminator

- Defines the end of the transcription process.
- Located downstream (towards the 3'-end of the coding strand).



The Reference Point Rule: All mapping (upstream/downstream) is conventionally defined by the polarity of the coding strand. If you switch the positions of the promoter and terminator, the definition of the coding and template strands would reverse!

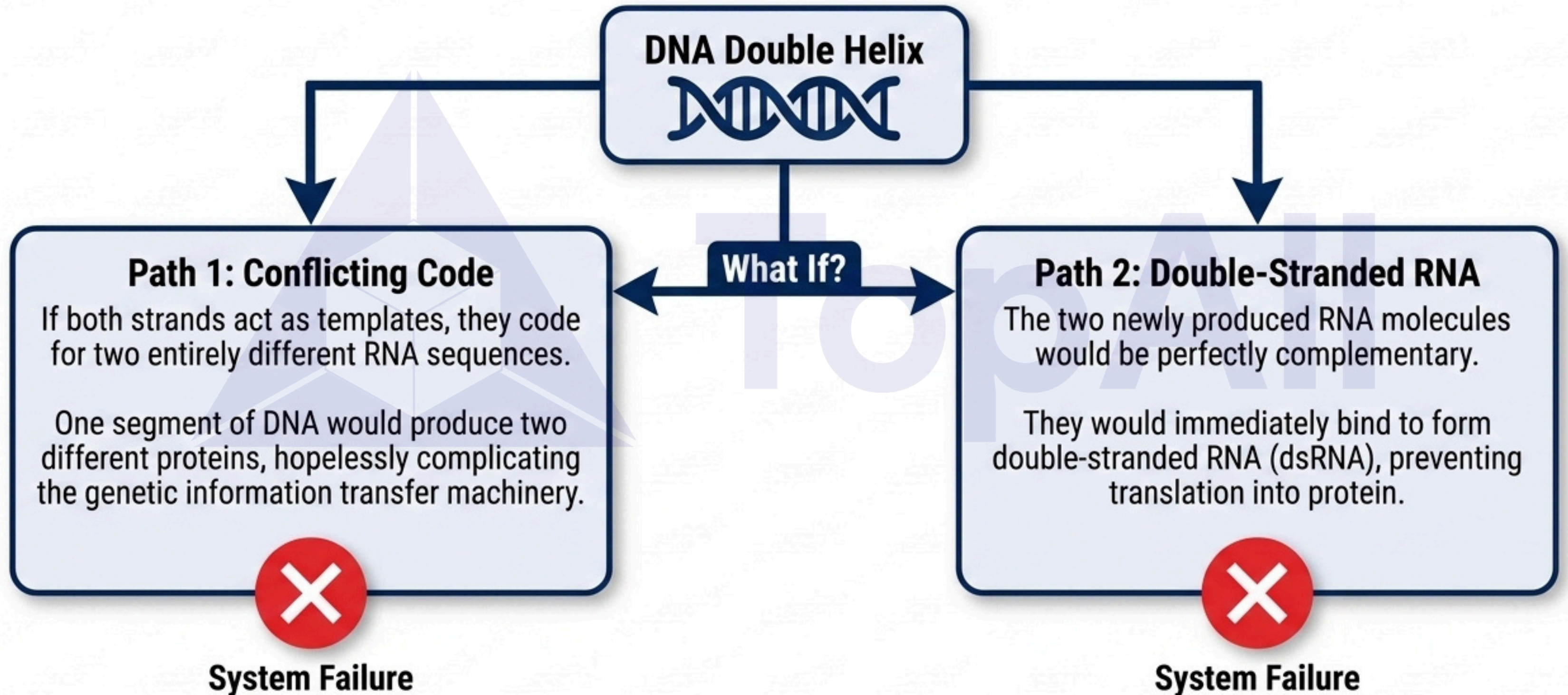
Distinguishing the Template and Coding strands

	Template Strand	Coding Strand
Polarity	3' → 5'	5' → 3'
Enzyme Action	RNA Polymerase only reads in this direction.	Displaced during transcription.
Output	Acts as the physical mold. RNA is complementary to it.	RNA sequence is identical to it (except U replaces T).



The Naming Paradox: The 'coding' strand does not actually code for anything during transcription. It gets its name simply because its sequence identically matches the final transcribed RNA product.

Why not transcribe both strands simultaneously?



Key takeaways: Synthesizing the molecular blueprint

- ✓ Transcription units are strictly bounded by a Promoter, a Structural Gene, and a Terminator.
- ✓ RNA polymerase only polymerizes in the $5' \rightarrow 3'$ direction, forcing the $3' \rightarrow 5'$ DNA strand to be the physical template.
- ✓ The non-template ($5' \rightarrow 3'$) strand establishes the reference point for all mapping (upstream vs. downstream).

Template Strand
($3' \rightarrow 5'$): A T G C A T G C

Coding Strand
($5' \rightarrow 3'$):

T A C G T A C G

Transcription

(Matches coding strand perfectly, with Uracil replacing Thymine)

Transcribed RNA
($5' \rightarrow 3'$):

U A C G U A C G



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