

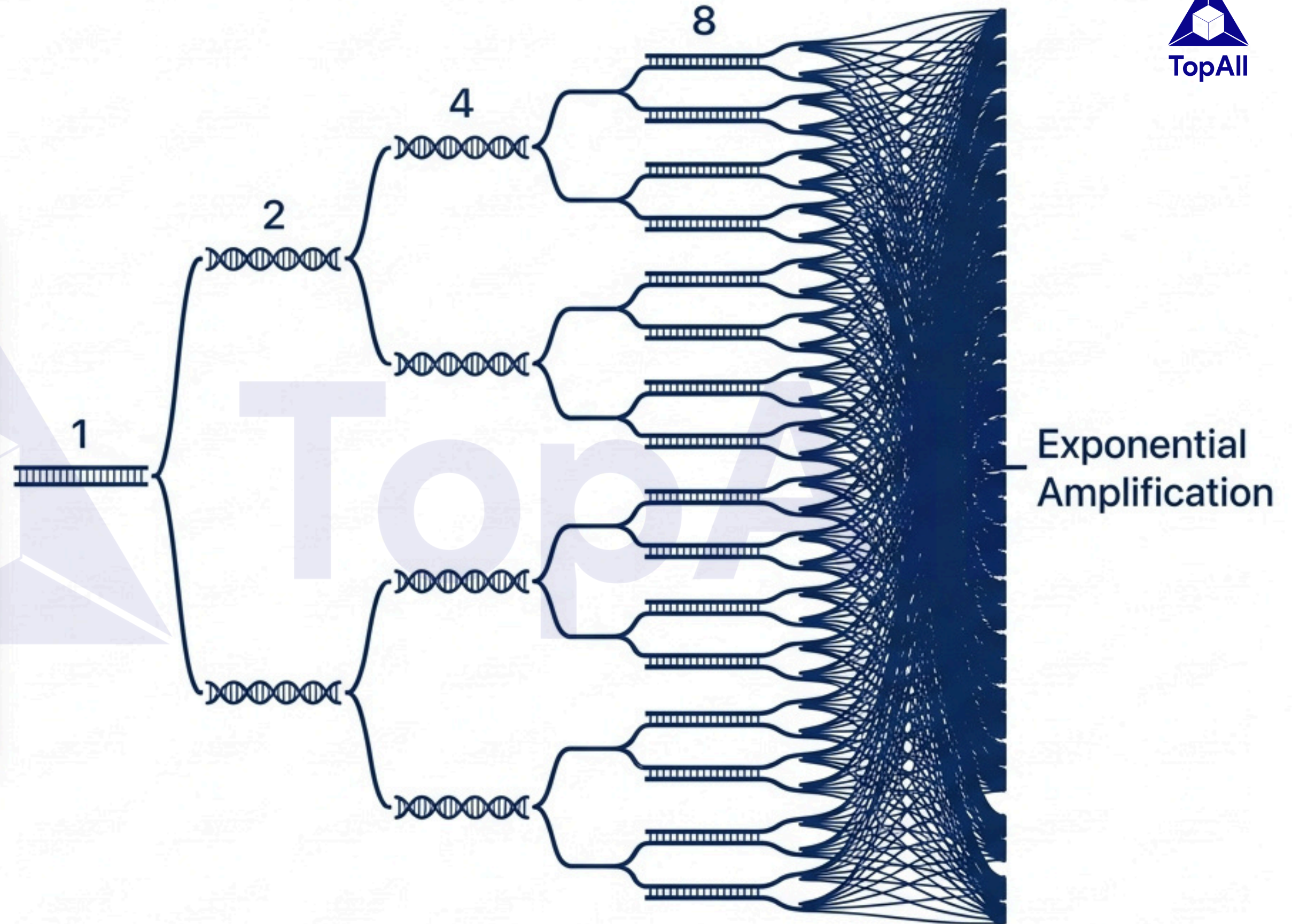
PCR: Billion Copies of DNA

The in vitro amplification of
genetic material.

What is PCR?

Polymerase Chain Reaction

A revolutionary technique used to synthesize multiple identical copies of a specific gene (or DNA segment) entirely in vitro (outside a living organism).



The Core Components



Primers

Small, chemically synthesized oligonucleotides. They are perfectly complementary to specific regions of the target DNA. (Two sets are required).



DNA Polymerase

The 'builder' enzyme. It uses genomic DNA as a template and raw deoxynucleotides to synthesize the new DNA strand.



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$$E=mc^2$$



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Key Highlights

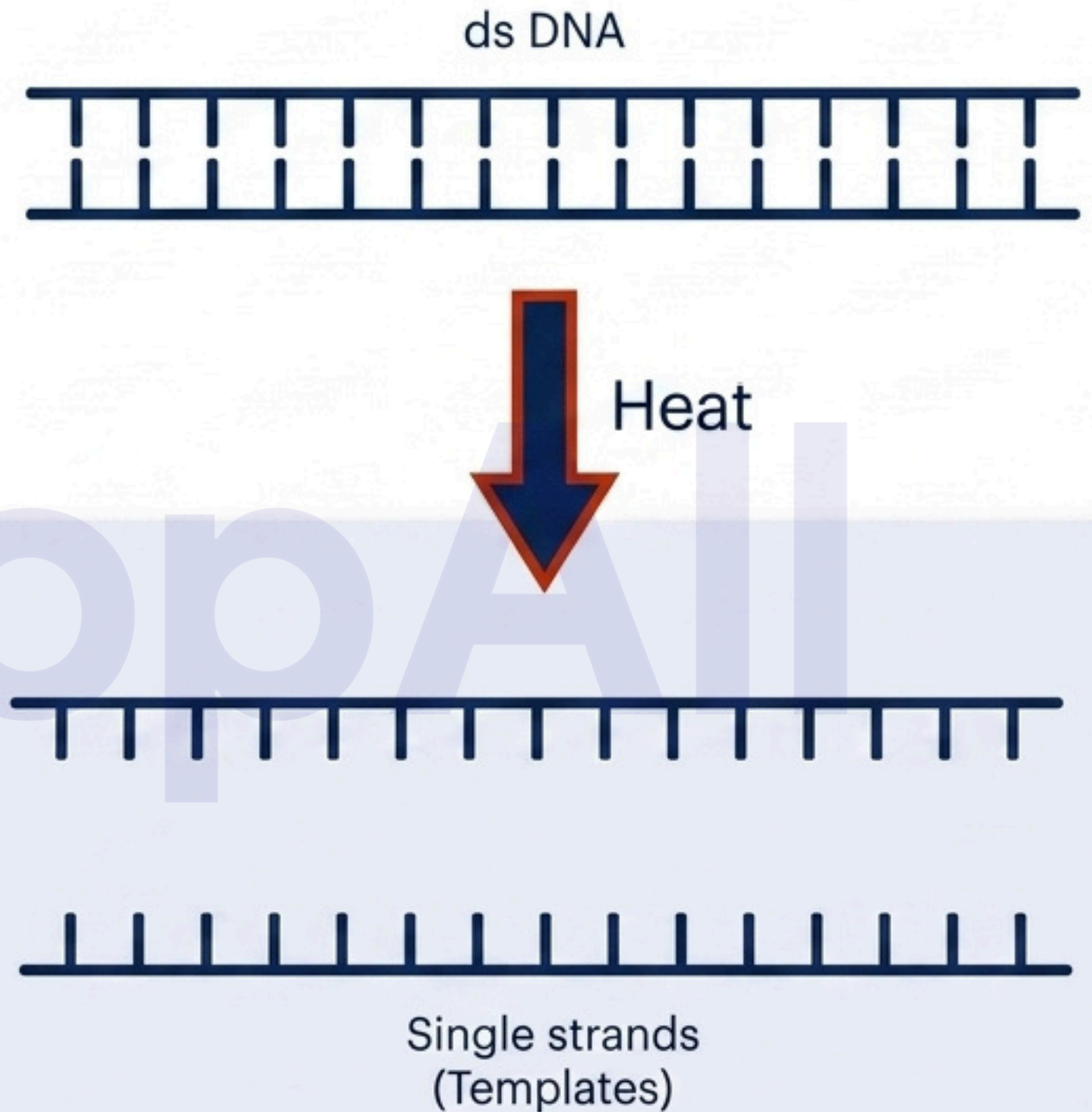
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Step 1: Denaturation

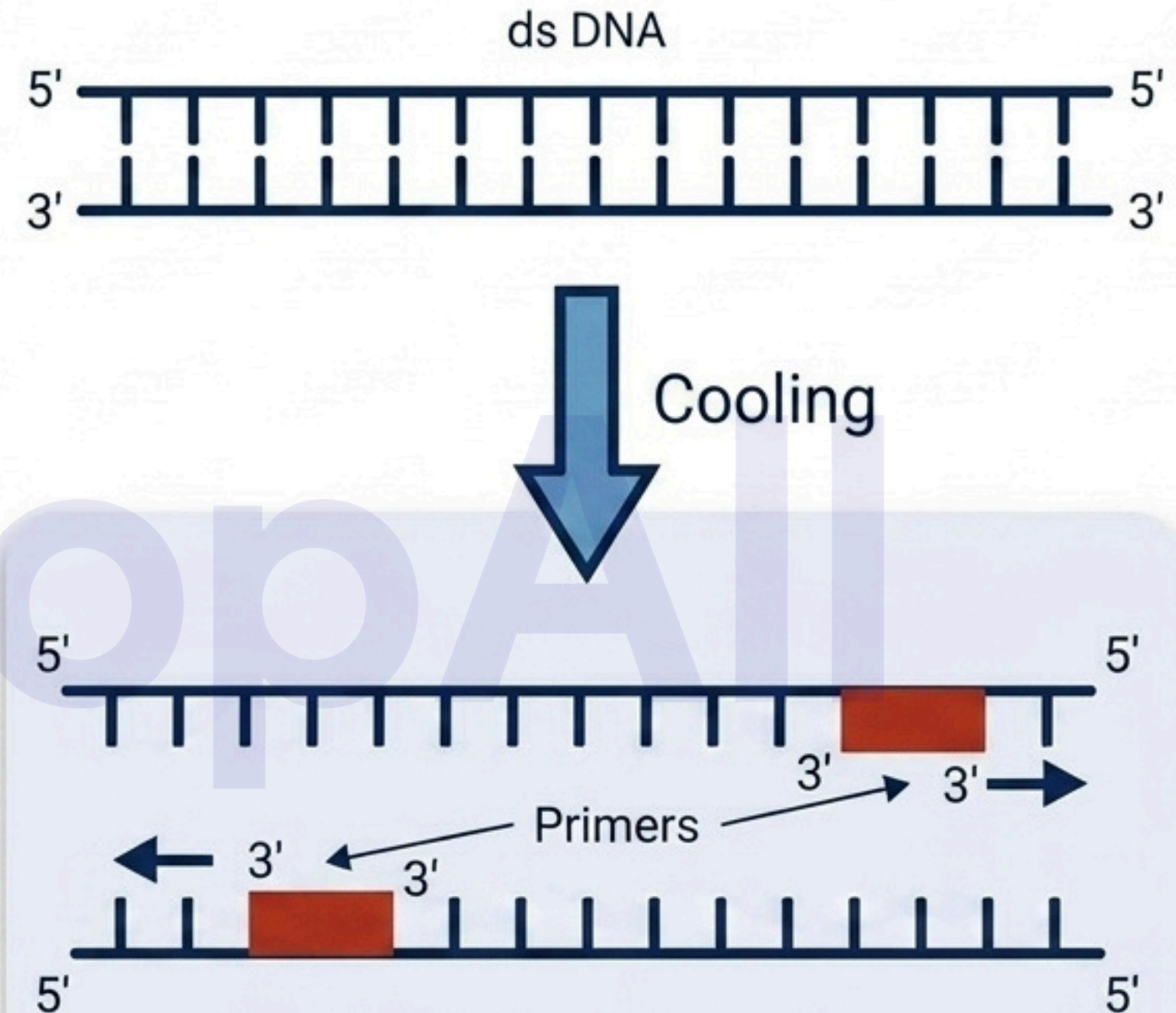
High heat is applied to the double-stranded DNA. This breaks the hydrogen bonds, forcing the helix to separate into two individual single strands.

Each single strand now acts as a template.



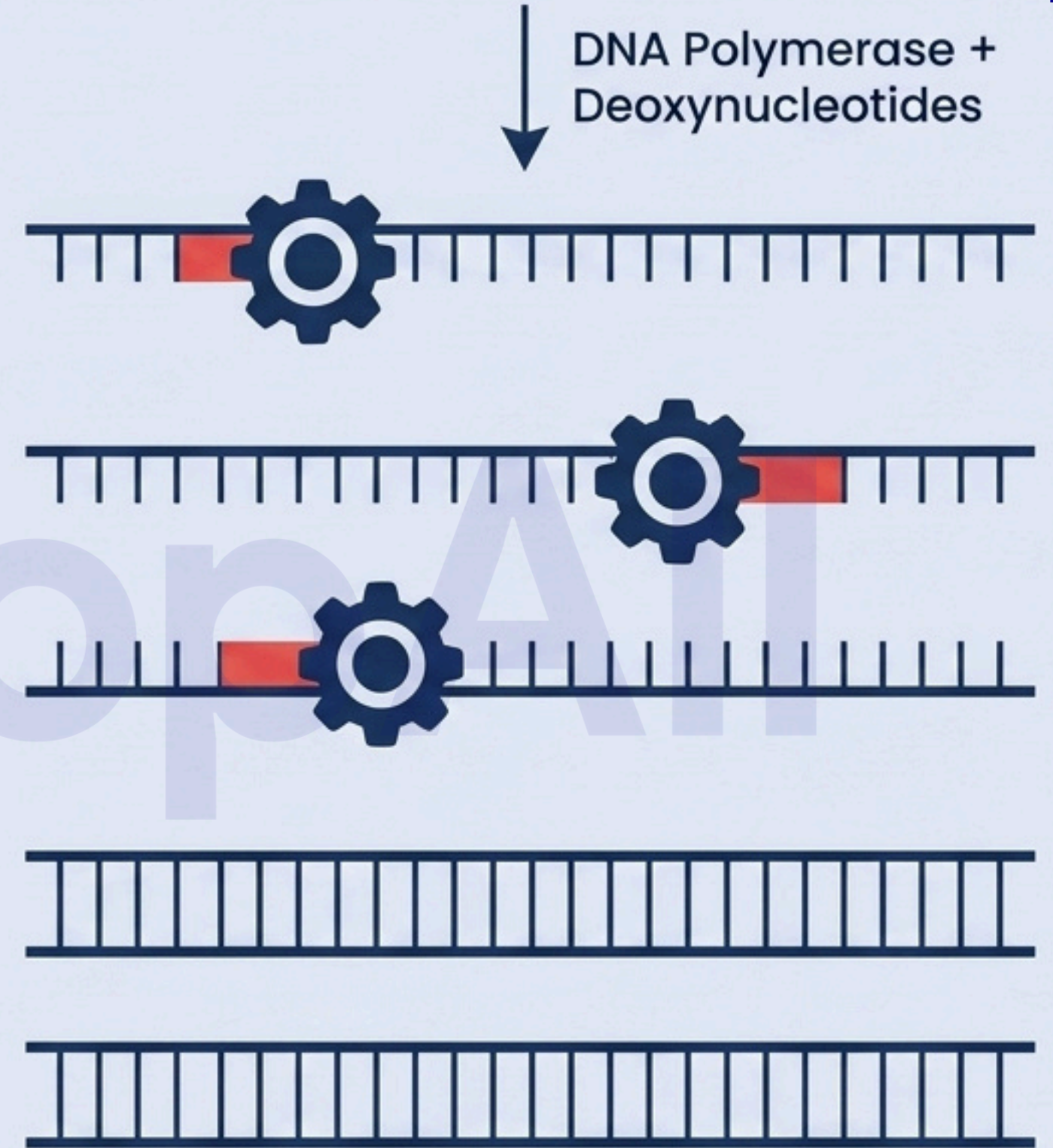
Step 2: Primer Annealing

The temperature is lowered. The two sets of primers bind (anneal) to their perfectly complementary sequences on the single-stranded DNA templates.



Step 3: Extension

DNA polymerase takes over. Using free deoxynucleotides provided in the mix, it extends the primers to synthesize completely new, complementary strands of DNA. One cycle yields two double-stranded copies.



NEET Key Takeaway: The Amplification Engine

Key Fact Box

**The secret to repeated cycles without destroying the enzyme?
Thermostable DNA Polymerase.**

Isolated from the bacterium *Thermus aquaticus* (Taq polymerase), this enzyme remains fully active even during the high-temperature denaturation phase.



30 cycles of PCR = approximately 1 billion identical copies of the target DNA.



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