

SECTION 10.2.2 // MITOSIS

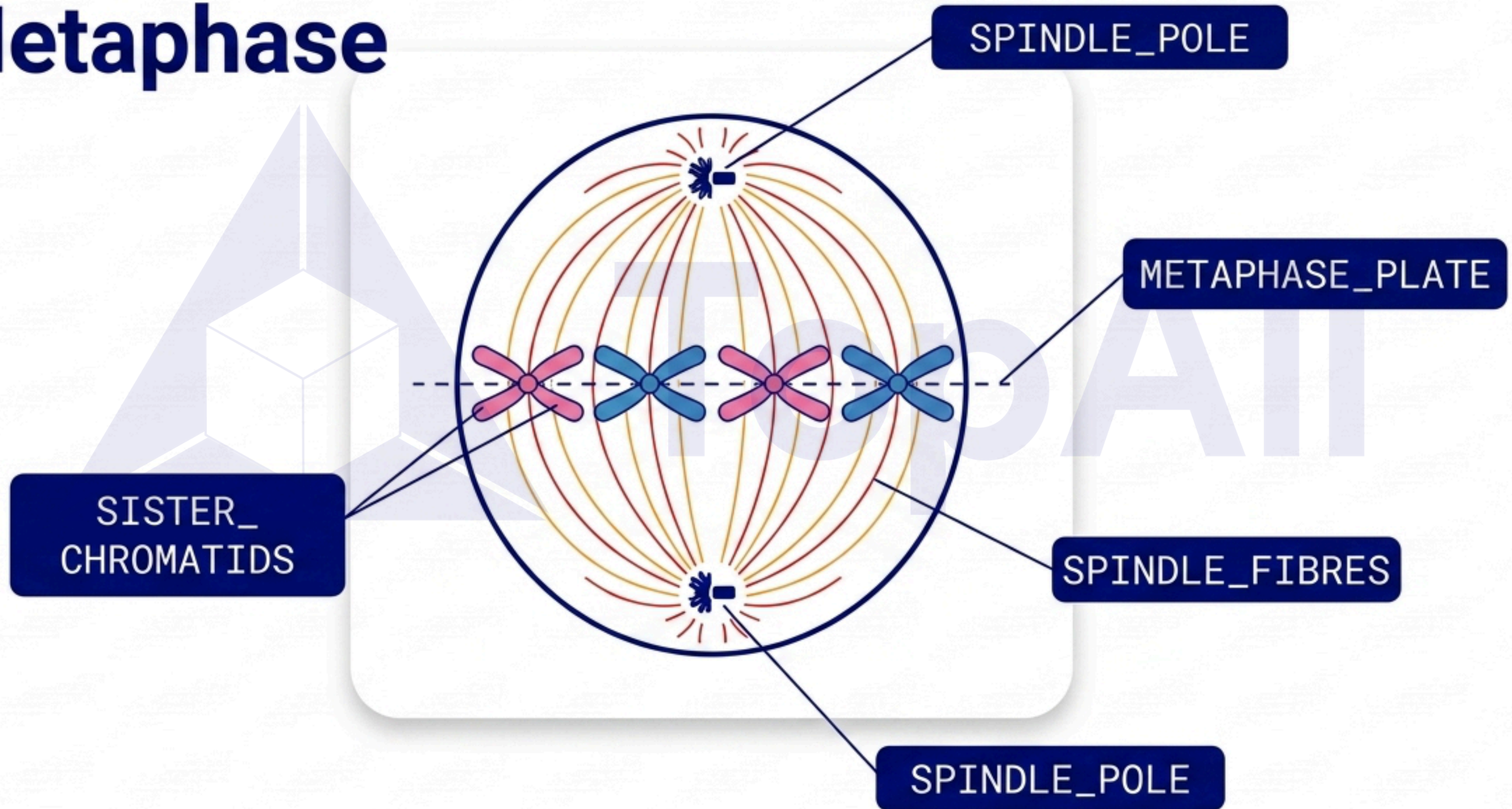
Chromosomes Line Up at the Equator

Understanding the architectural precision of Metaphase during cellular Mitosis.

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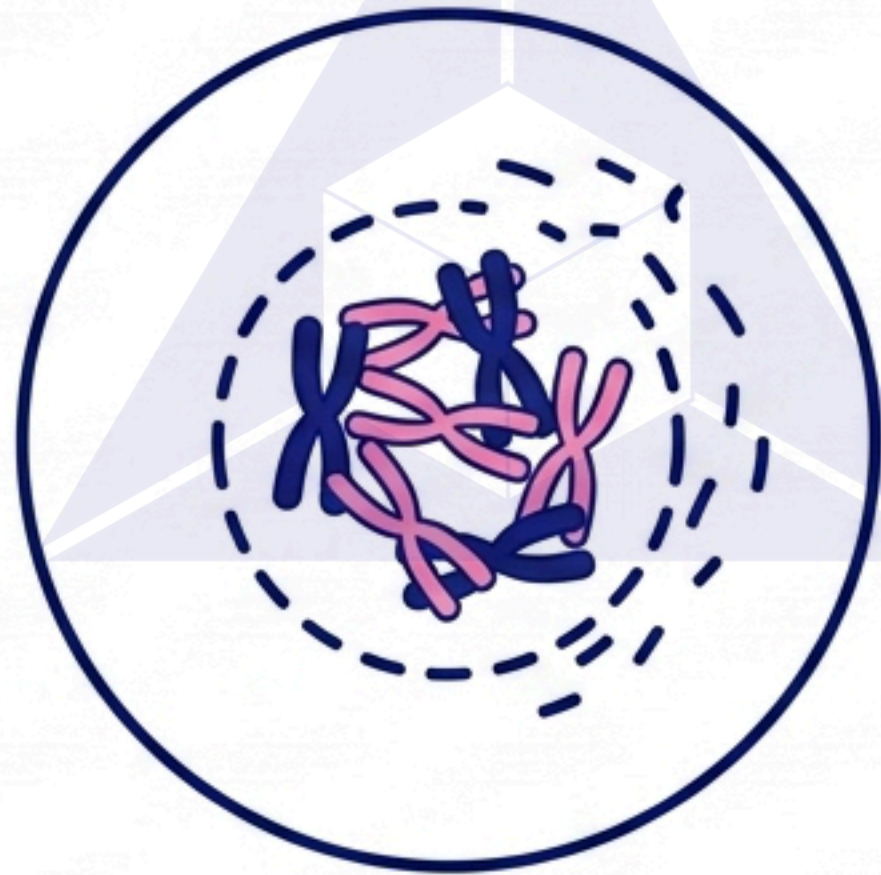


The Geography of Metaphase



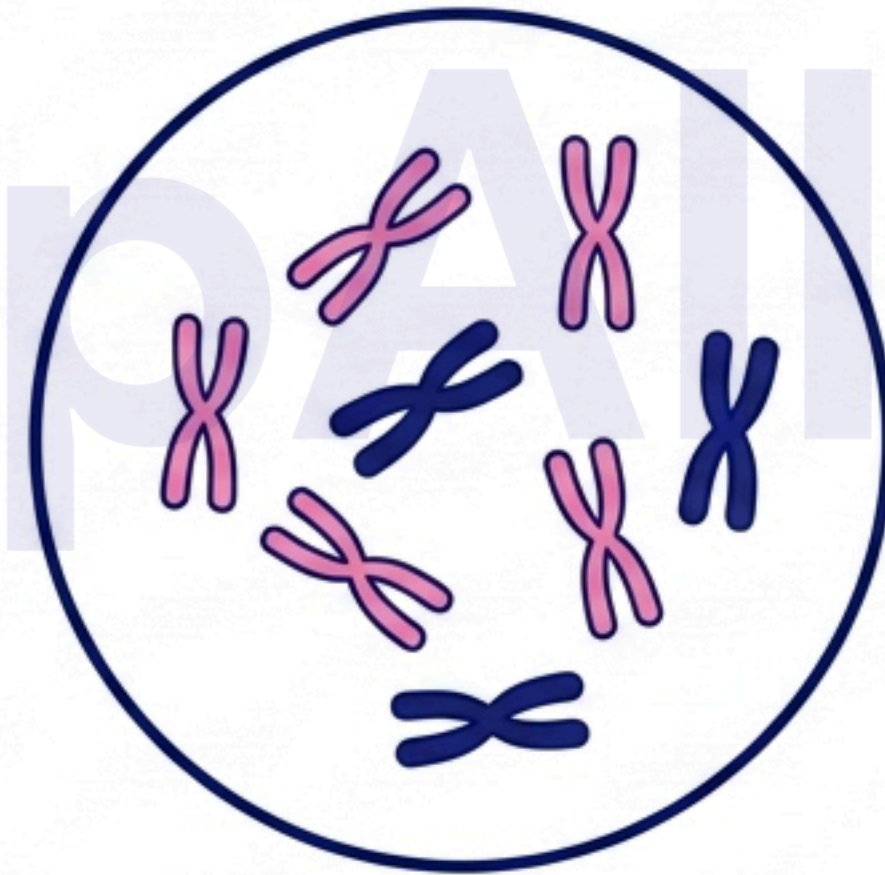
The Envelope Disintegrates

The complete breakdown of the nuclear envelope acts as the official starting gun for metaphase. Without this barrier, chromosomes are released directly into the cellular cytoplasm, allowing the spindle fibers to reach them.



STATE: LATE_PROPHASE

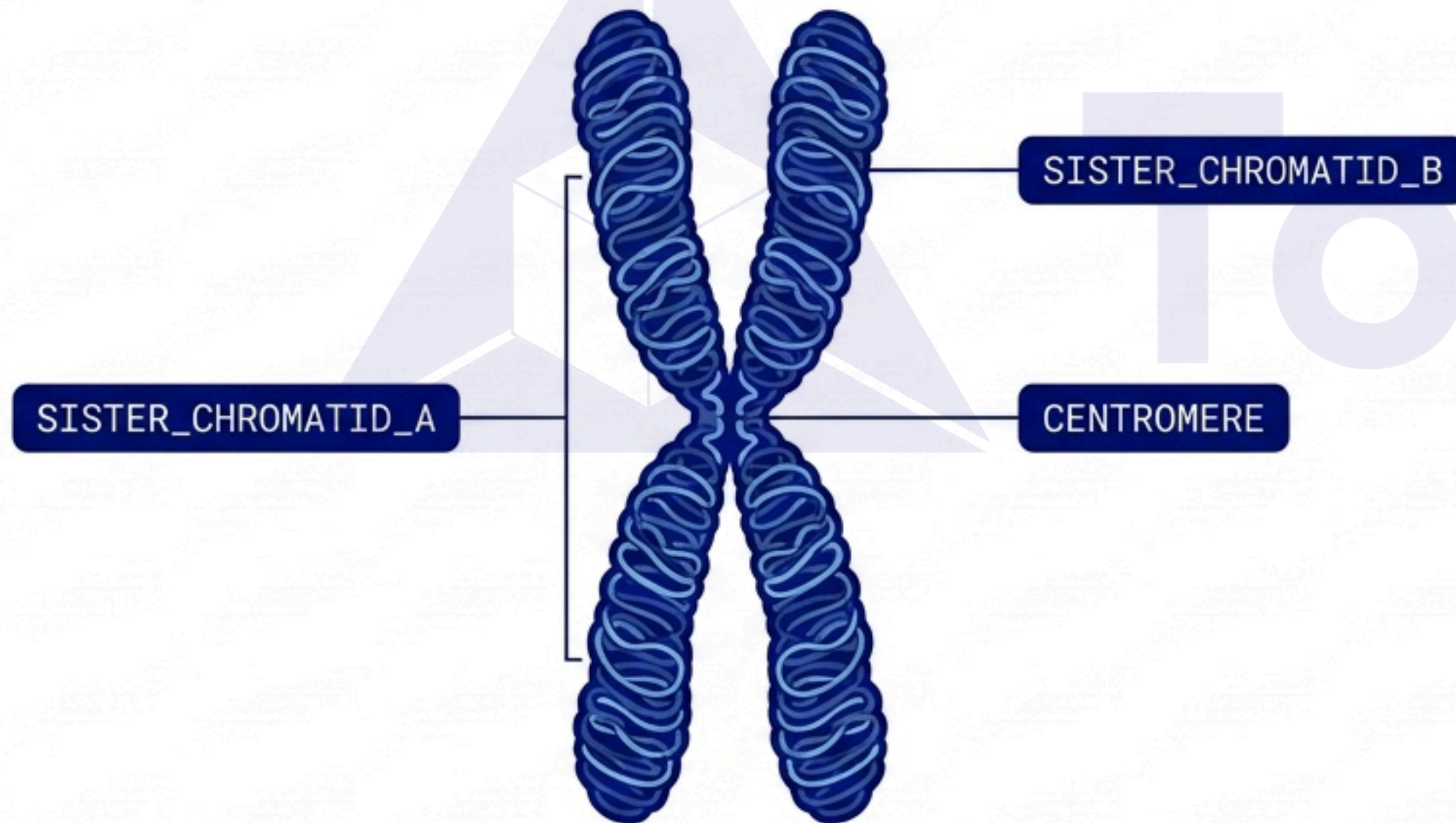
PHASE_TRANSITION:
PROPHASE -> METAPHASE



STATE: EARLY_METAPHASE

Maximum Condensation

By the time metaphase begins, chromosomal condensation is entirely complete. The genetic material is tightly packed into two distinct sister chromatids held together by a central centromere.



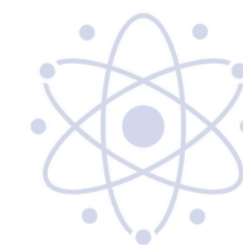
Observation Window

Because condensation is at its absolute peak, metaphase is the specific stage where the morphology of chromosomes is most easily observed and studied under a microscope.



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$$E=mc^2$$



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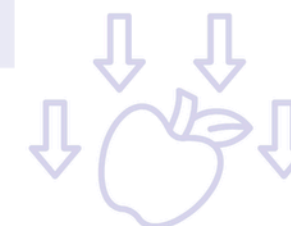
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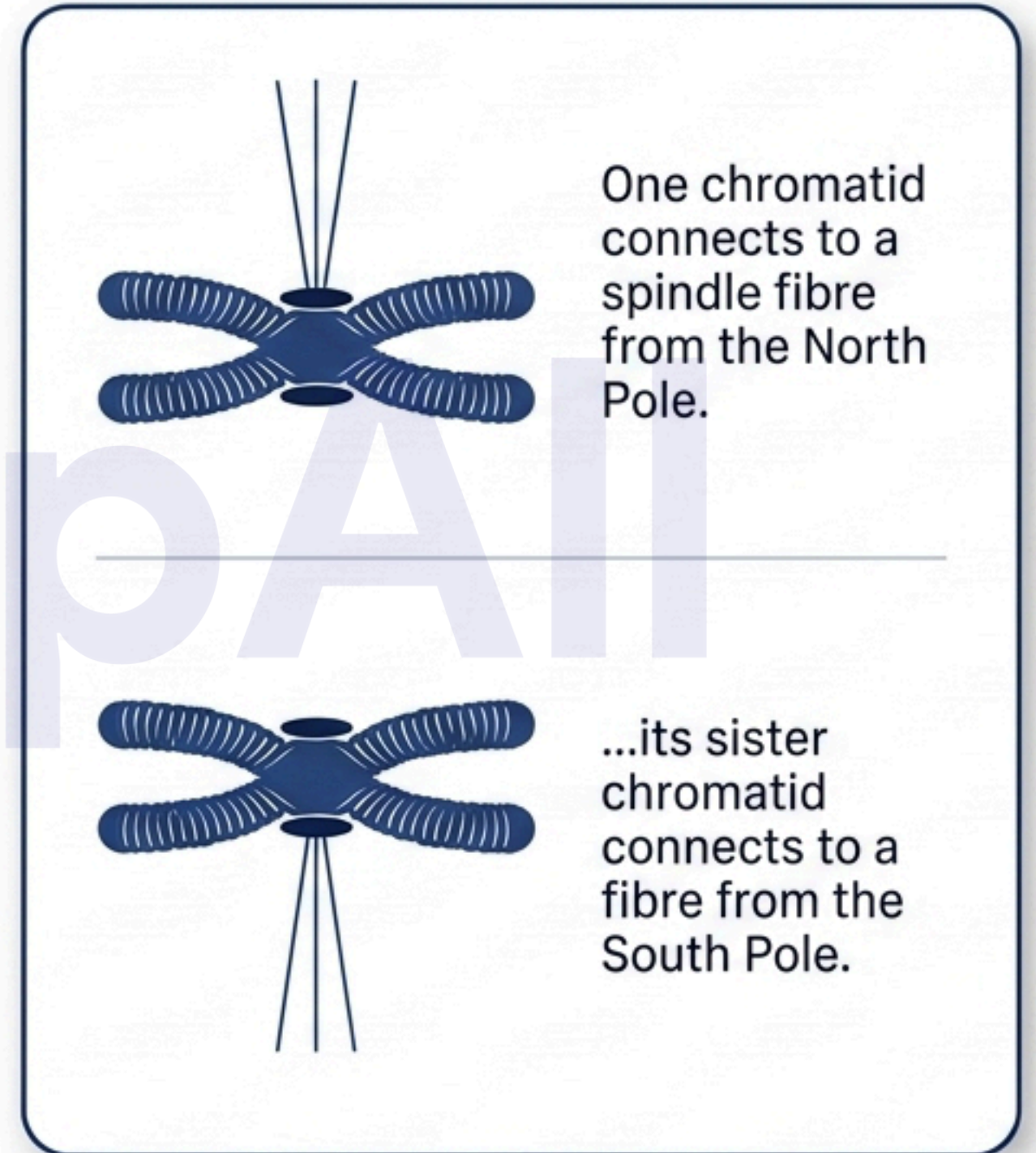
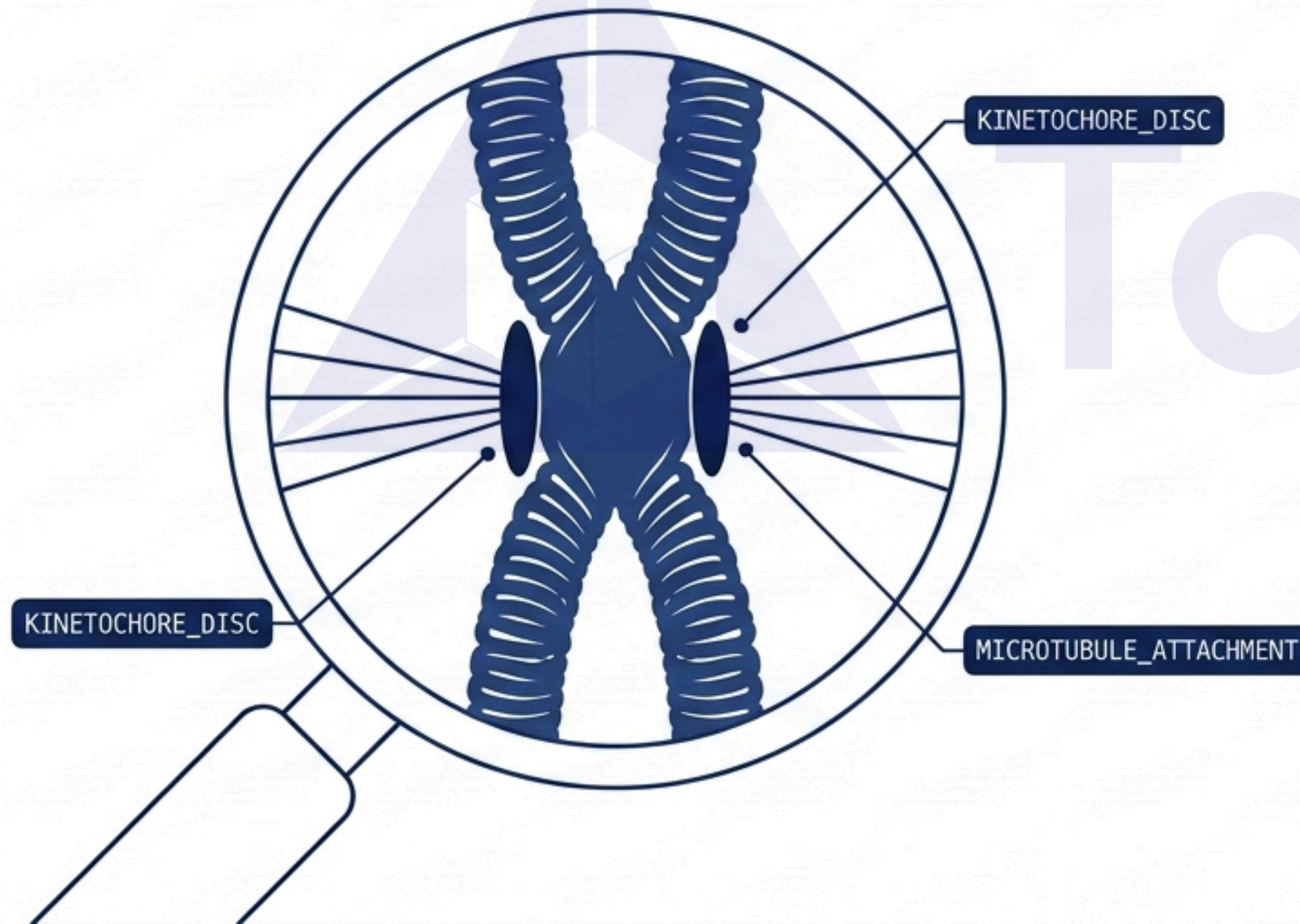
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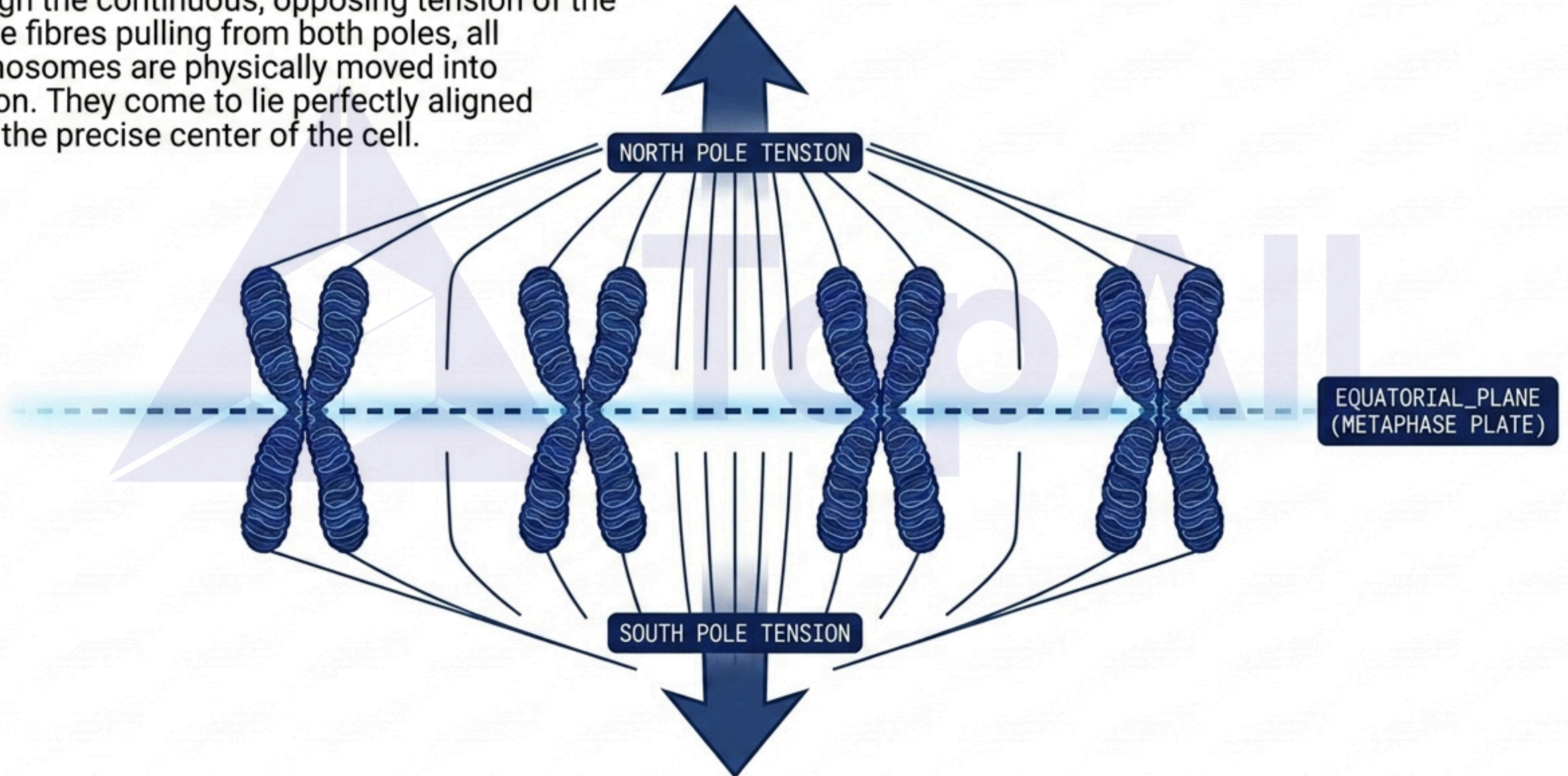
The Machinery of Attachment

Small, disc-shaped protein structures called kinetochores assemble on the surface of the centromeres. They act as the physical anchor points for the spindle fibres radiating from the cell's opposite poles.



Forming the Metaphase Plate

Through the continuous, opposing tension of the spindle fibres pulling from both poles, all chromosomes are physically moved into position. They come to lie perfectly aligned along the precise center of the cell.



Metaphase: The Essentials

The Two Core Mechanisms of Metaphase

1. Spindle fibres successfully attach to the kinetochores of all chromosomes.
2. Chromosomes are moved to the spindle equator, perfectly aligning along the metaphase plate via bipolar spindle fibre tension.

System Checkpoint

Cell division cannot progress to Anaphase until every single chromosome is properly aligned at this equatorial plate.

NEXT_PHASE: ANAPHASE



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