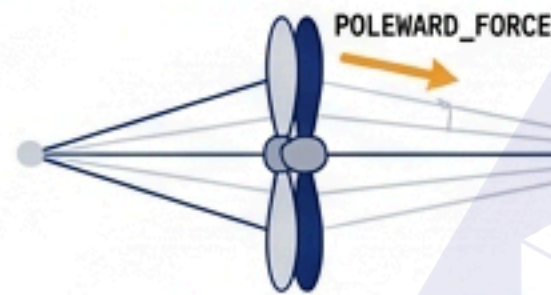


DYNAMIC MECHANICAL ACTIONS

SPINDLE FIBER SHORTENING

MECHANISM: Depolymerization at Kinetochore Ends

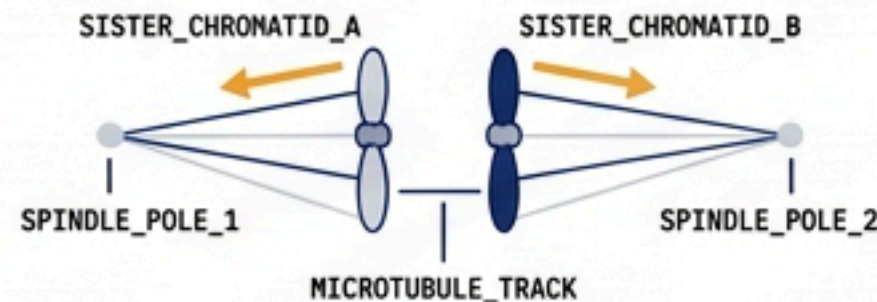
$$\text{LENGTH_DECREASE} = f(\text{MOTOR_PROTEIN_ACTIVITY})$$



POLEWARD MOVEMENT

RESULT: Sister Chromatids Pulled to Opposite Poles

$$\text{VELOCITY_CHROMATID} = V_{\text{POLE}} + V_{\text{DEPOLYMERIZATION}}$$



SECTION 10.2.3

Sister Chromatids Move Apart

The Mechanics of Anaphase in Mitosis

SYNTHESIZING TAKEAWAY: ANAPHASE PRECISION

CORE PROCESS:

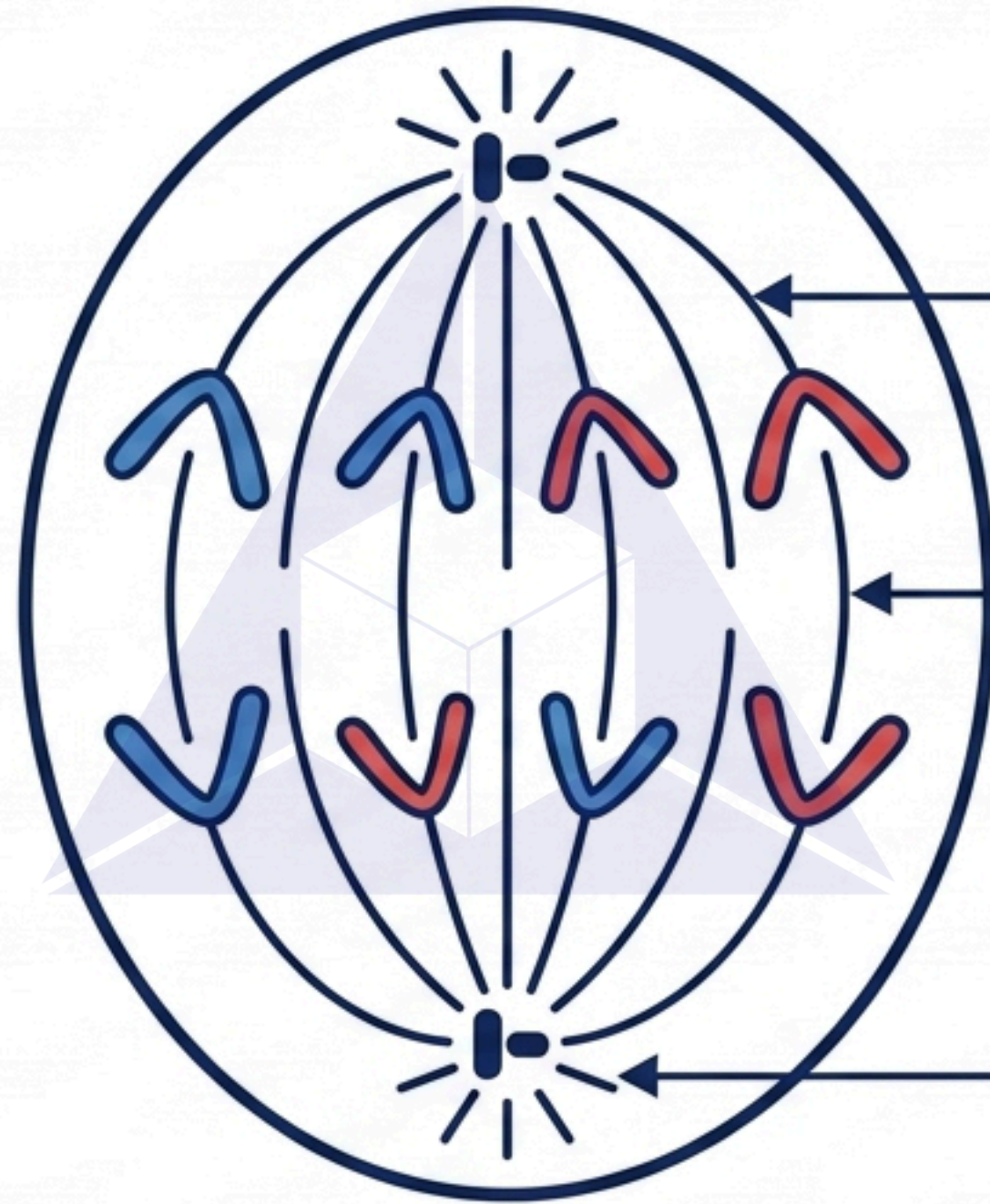
Physical Separation: Sister chromatids are abruptly separated and pulled towards opposite ends of the cell. This ensures that each daughter cell receives a complete and identical set of chromosomes. This critical step relies on the synchronized activity of motor proteins and microtubule dynamics.

KEY OUTCOME:

Temporal Coordination: Anaphase occurs simultaneously for all chromosomes, triggered by the Anaphase-Promoting Complex/Cyclosome (APC/C). This global regulation is essential to prevent aneuploidy and maintain genetic stability, fulfilling the cellular checkpoint requirement.

CLINICAL RELEVANCE: Errors in this phase are linked to chromosomal instability, a hallmark of cancer cells.

The Anatomy of Anaphase

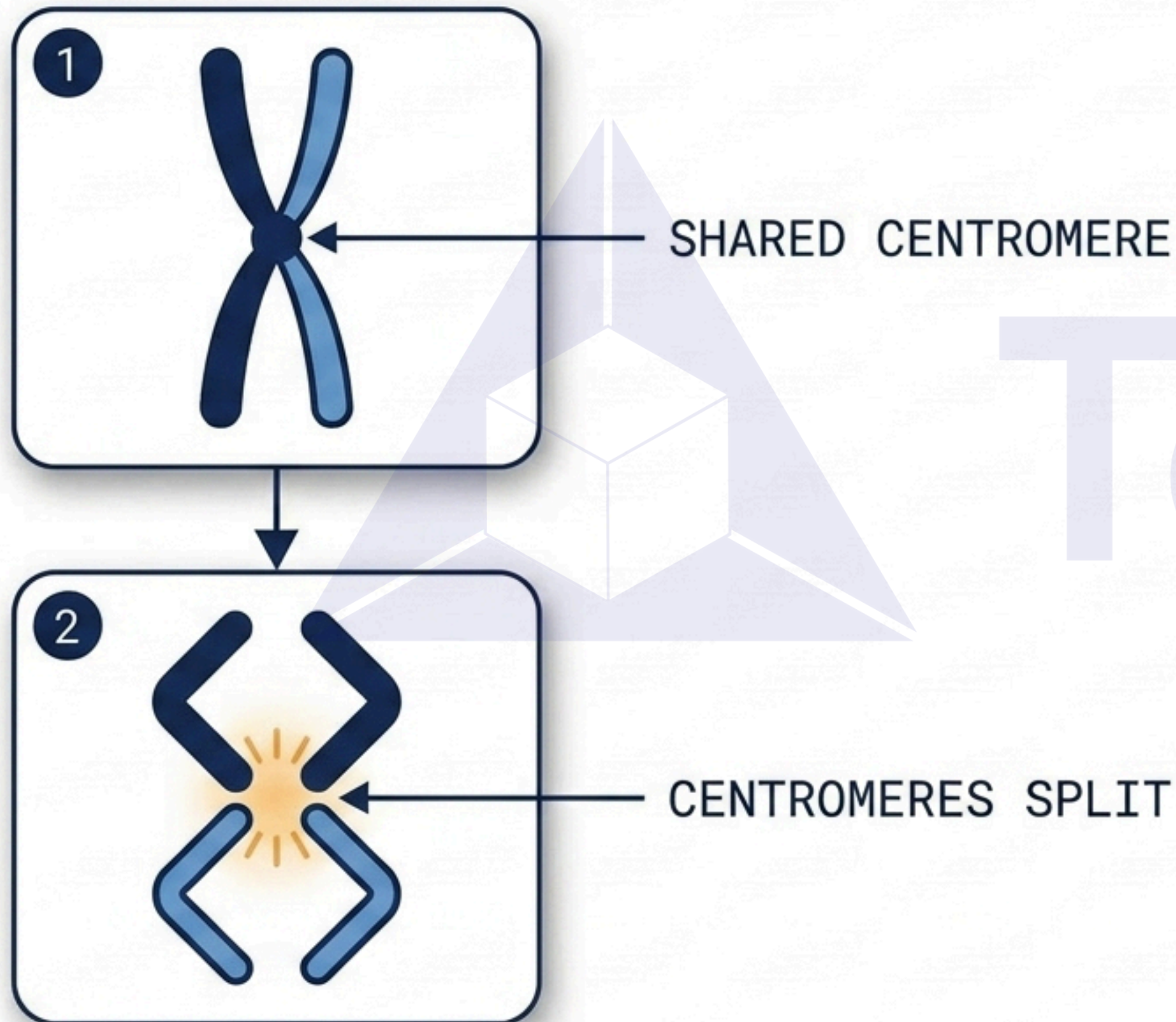


SPINDLE FIBRES

DAUGHTER
CHROMOSOMES

OPPOSITE POLES

The Trigger: Centromere Splitting



At the precise onset of anaphase, the centromeres holding sister chromatids together split simultaneously across the entire metaphase plate. This synchronous mechanical fracture is the fundamental catalyst that allows migration to begin.



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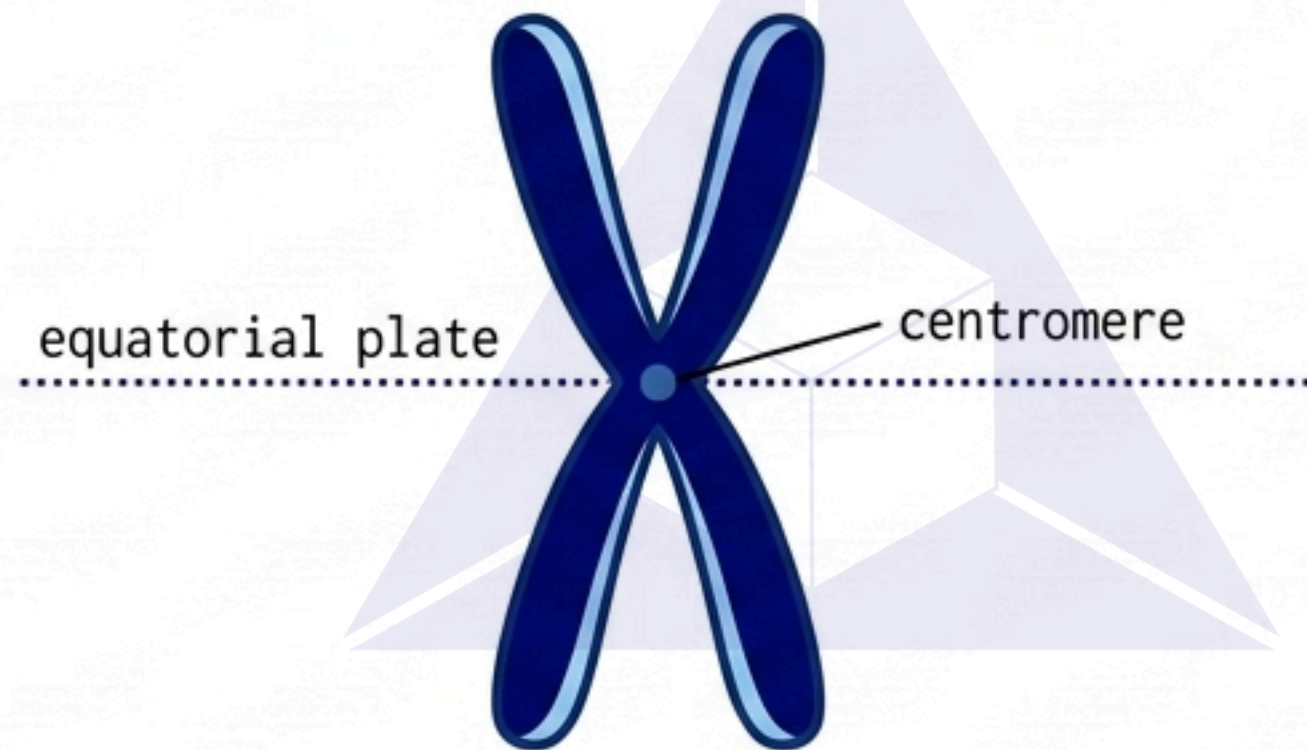
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A Shift in Identity

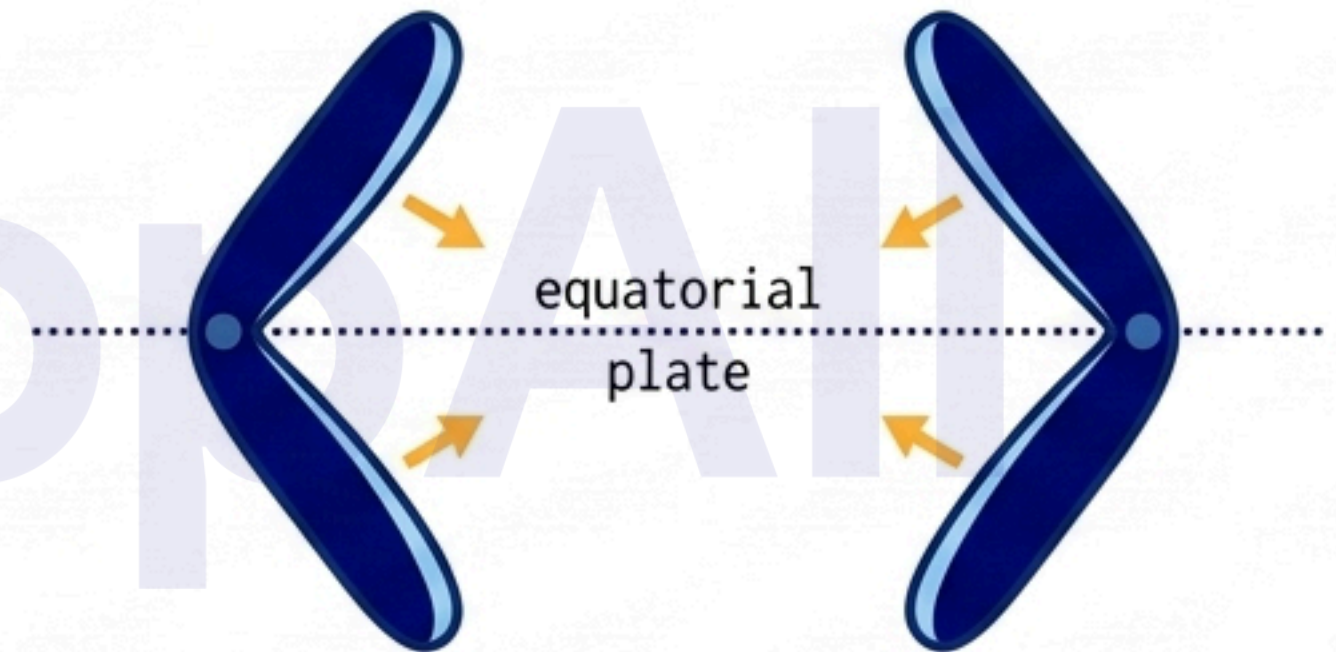
Sister Chromatids



They are two identical halves of one duplicated chromosome, physically bound together.

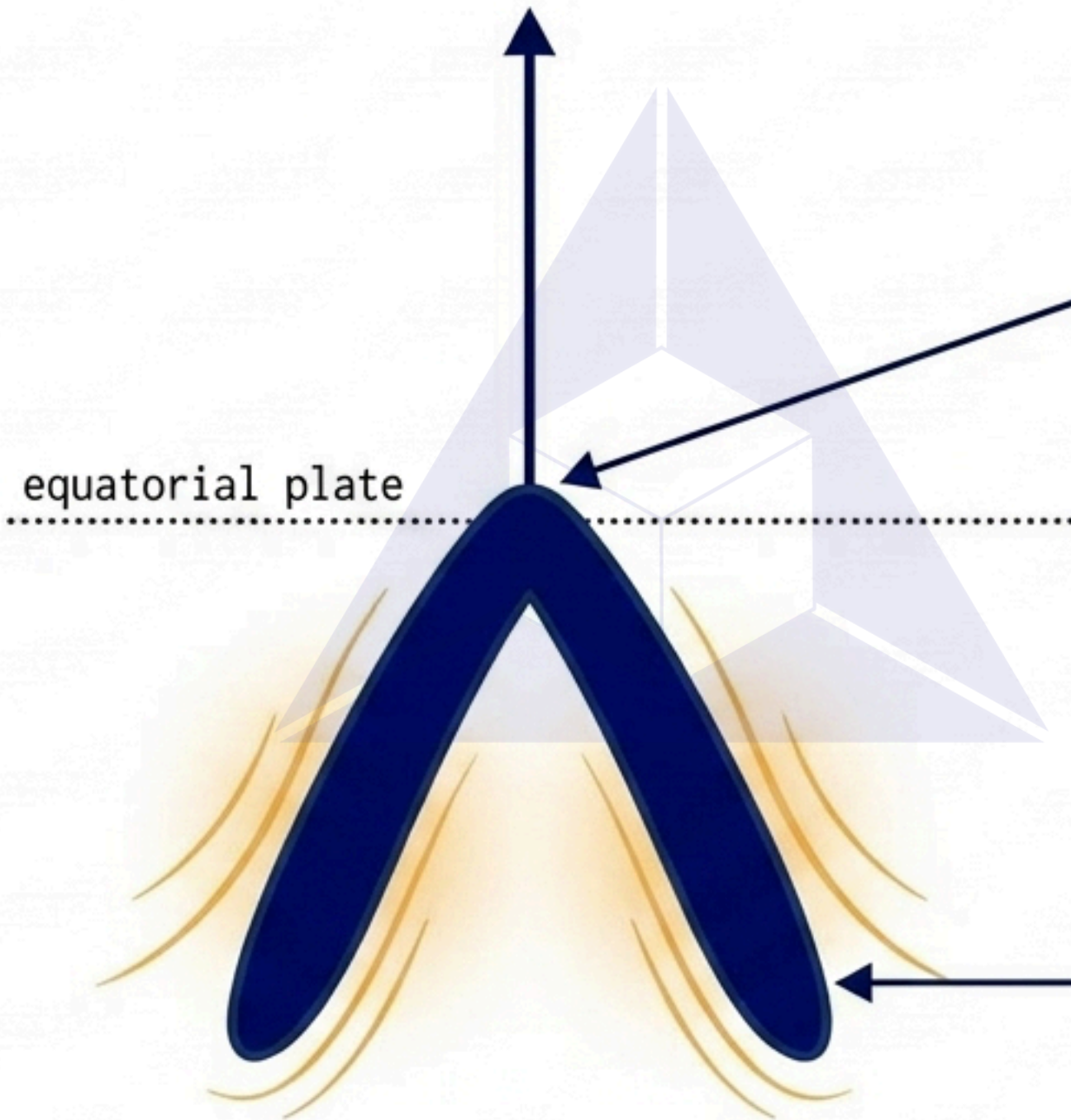


Daughter Chromosomes



Once separated, they are instantly recognized as individual, independent chromosomes of the future daughter nuclei.

The Physics of Migration



The **centromere** remains directed toward the pole. It acts as the leading edge, anchoring the pulling force of the spindle apparatus.

The **arms** of the chromosome trail behind, forming a distinct "V" or "U" shape due to the physical drag of the cytoplasm.

Equational Division Achieved



Anaphase guarantees that each new daughter cell will receive an exact, identical copy of the parent cell's genome.

PARENT: $2n$ → DAUGHTER 1: $2n$ & DAUGHTER 2: $2n$

By physically splitting the replicated chromosomes and systematically dragging them to opposite poles, the cell perfectly conserves its specific chromosome number. This mechanical precision is the foundation of equational division.



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