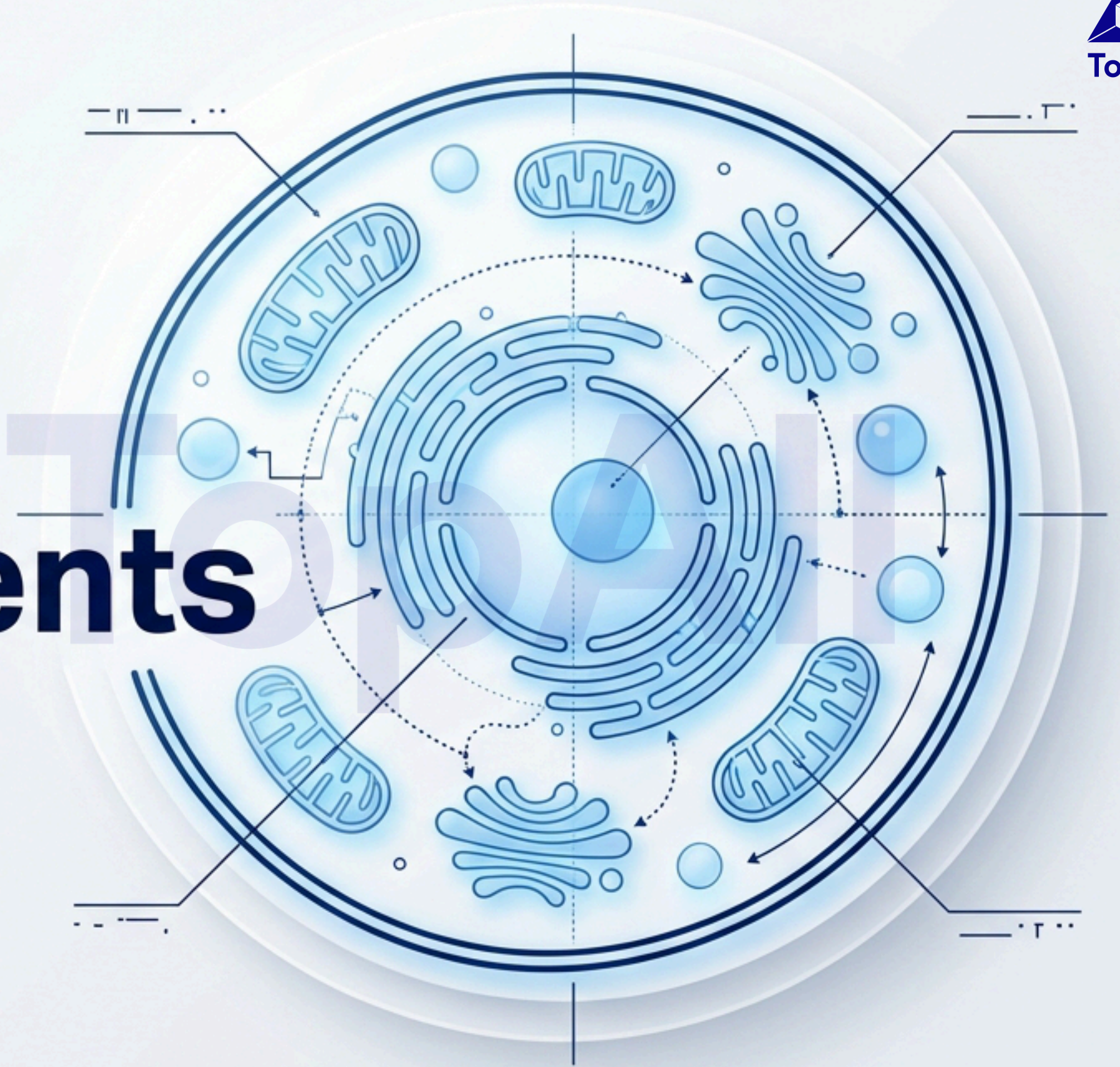


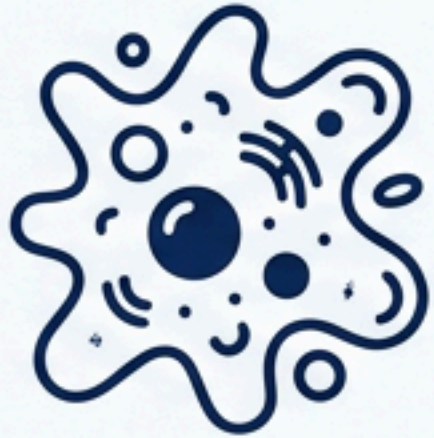
SECTION 8.5

Cells with Compartments

The Architecture of
Eukaryotic Life



The Eukaryotic Domain



PROTISTS

Single-celled organisms with complex internal structures.



FUNGI

Heterotrophic organisms featuring an outer cell wall.



PLANTS

Autotrophs defined by rigid cell walls, large central vacuoles, and plastids.



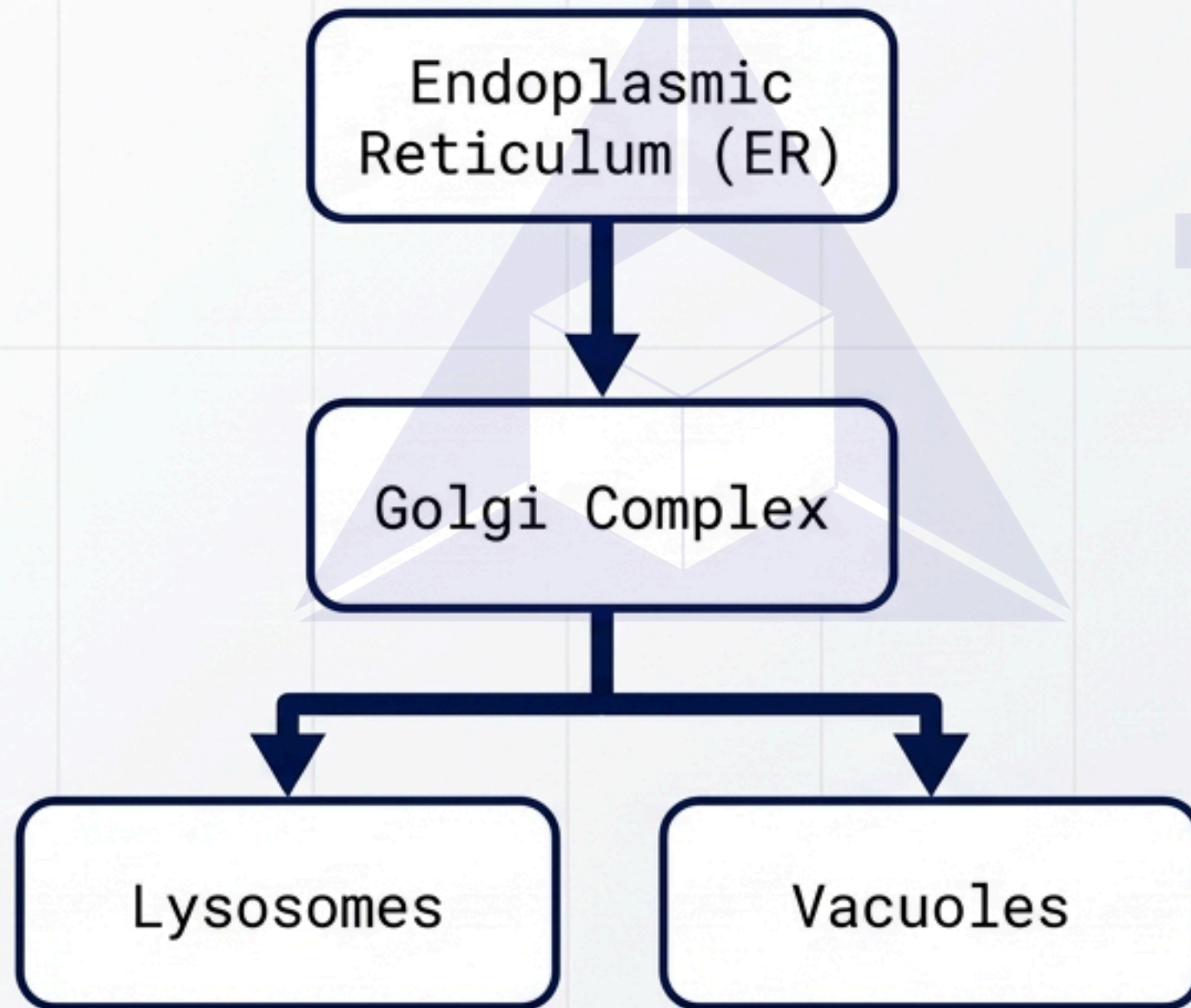
ANIMALS

Organisms with flexible plasma membranes (no cell wall) and specialized centrioles.

Defining Trait: Extensive compartmentalisation of cytoplasm via membrane-bound organelles and an organised nucleus.

Organelle Systems & Division of Labor

Zone 1. The Endomembrane System (Coordinated Functions)



Zone 2: Independent Energy & Support (Non-coordinated)

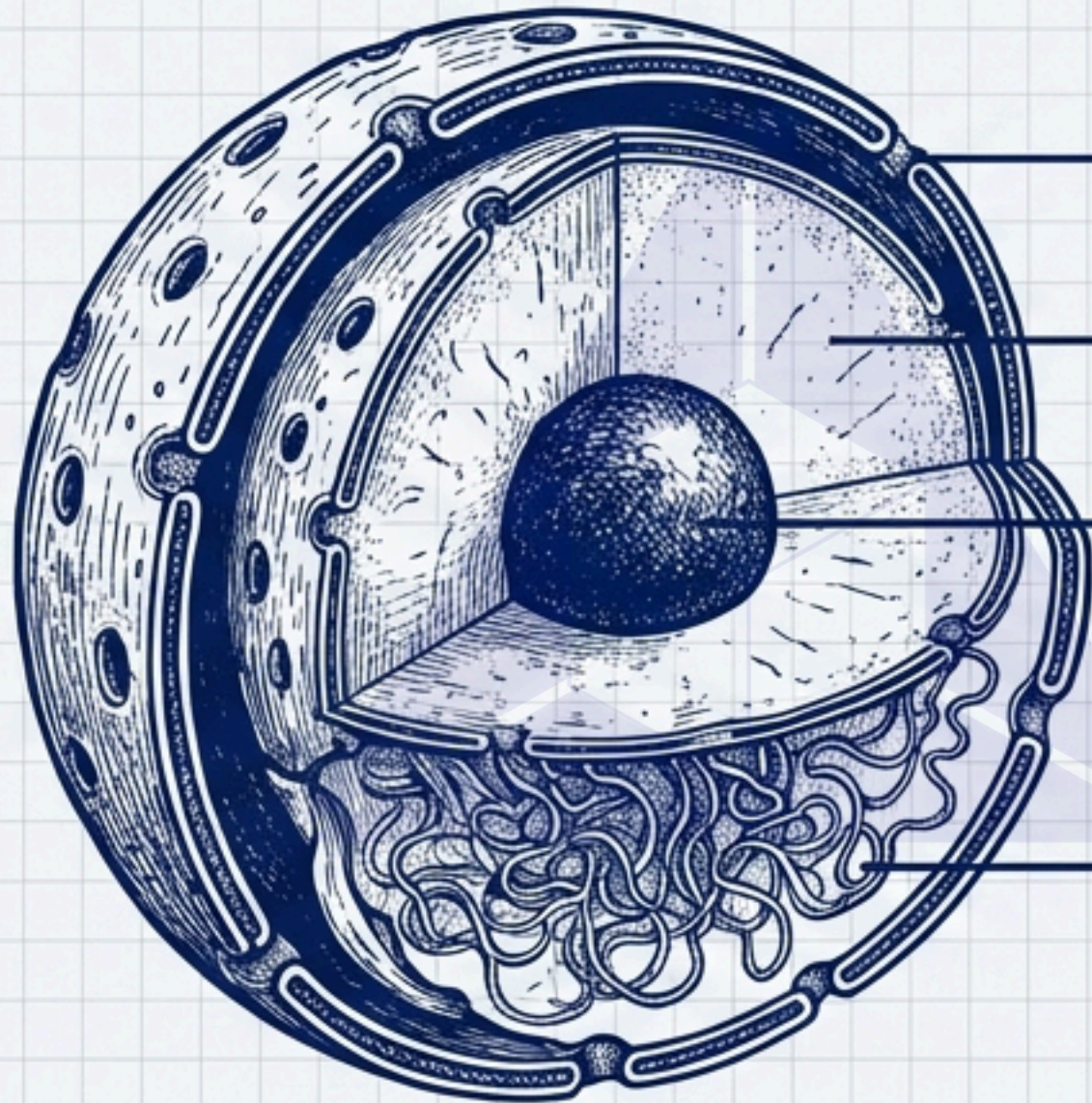
Mitochondria
(Aerobic respiration / ATP)

Plastids
(Photosynthesis in plants)

Microbodies

Structural Exception:
Ribosomes (80S in cytoplasm) and **Centrosomes** are crucial cellular organelles, but they are non-membrane bound.

The Command Center: Organised Nucleus



Nuclear Envelope

Two parallel membranes separated by a perinuclear space (10-50 nm). Features minute pores formed by membrane fusion, acting as passages for RNA and protein transport.

Nucleoplasm

The nuclear matrix containing the active internal structures.

Nucleolus

A spherical, non-membrane bound body continuous with the nucleoplasm. The site of active ribosomal RNA (rRNA) synthesis.

Chromatin

Highly extended and elaborate nucleoprotein fibres (DNA + histones) present during interphase.

Exception: Mature mammalian erythrocytes and vascular plant sieve tube cells lack a nucleus.



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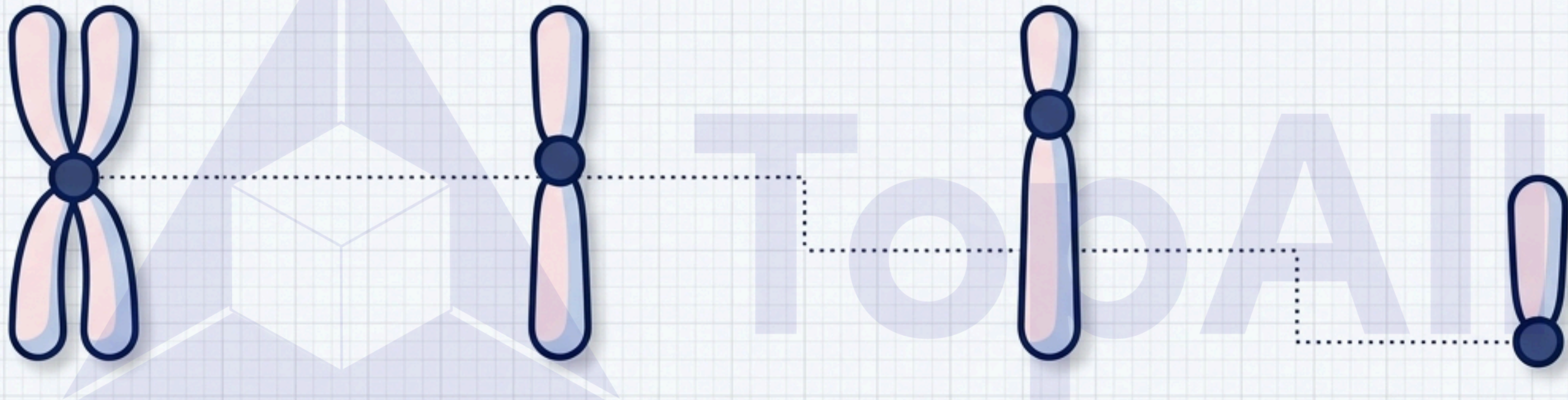
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Packaging the Genetic Payload

During cell division, chromatin structures into distinct chromosomes featuring a primary constriction (**centromere**) flanked by disc-shaped kinetochores.



METACENTRIC

Middle centromere forming two equal arms.

SUB-METACENTRIC

Slightly off-middle centromere (one shorter arm, one longer arm).

ACROCENTRIC

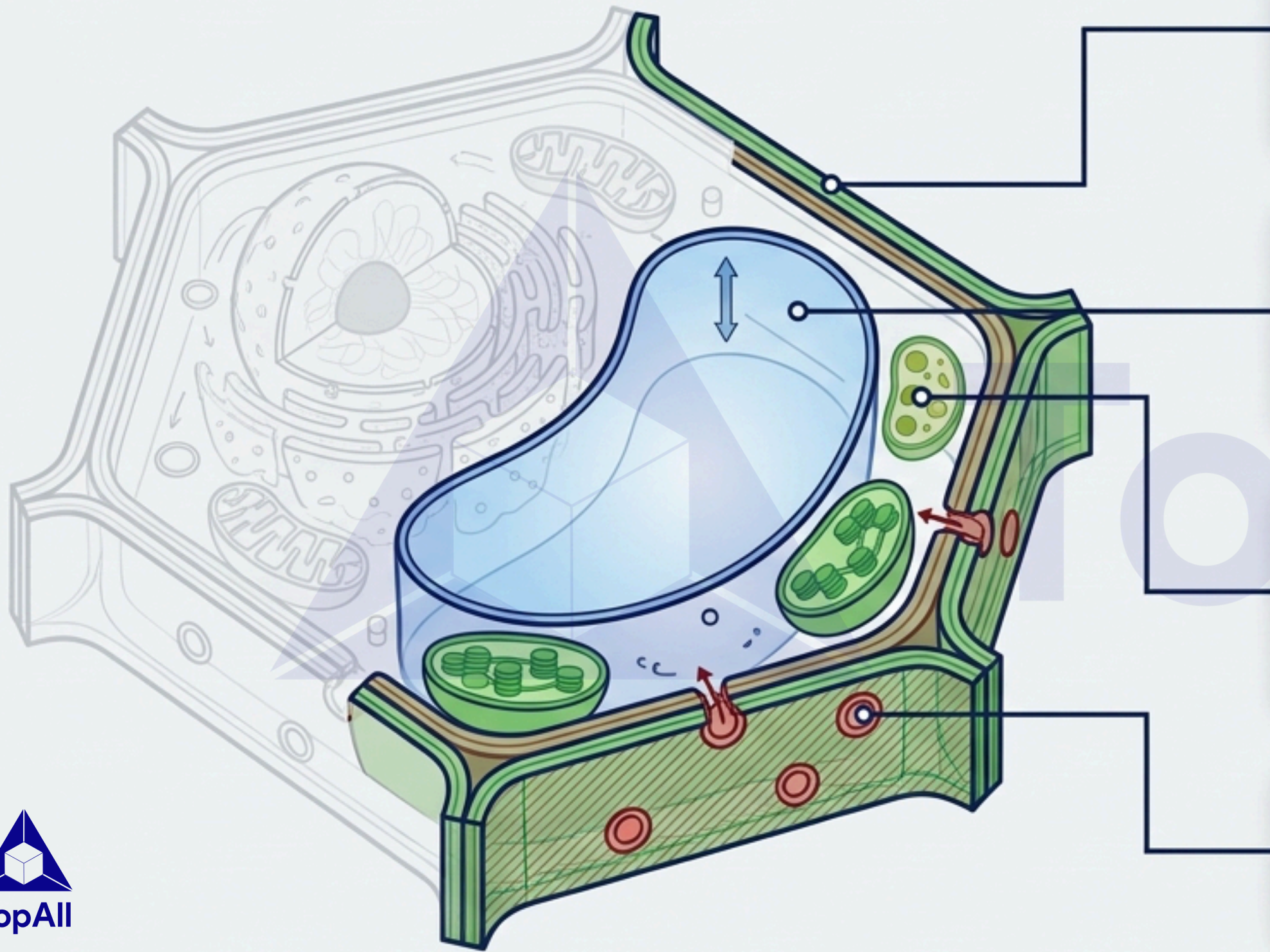
Centromere close to the end (extremely short arm + very long arm).

TELOCENTRIC

Terminal centromere.

Some chromosomes feature a non-staining secondary constriction at a constant location, creating a small fragment known as a satellite.

The Plant Cell Blueprint



Cell Wall

Rigid outer layer made of cellulose, hemicellulose, and pectins. Adjacent cells are glued together by the calcium pectate middle lamella.

Central Vacuole

Bound by a single membrane (tonoplast), occupying up to 90% of cell volume to maintain concentration gradients.

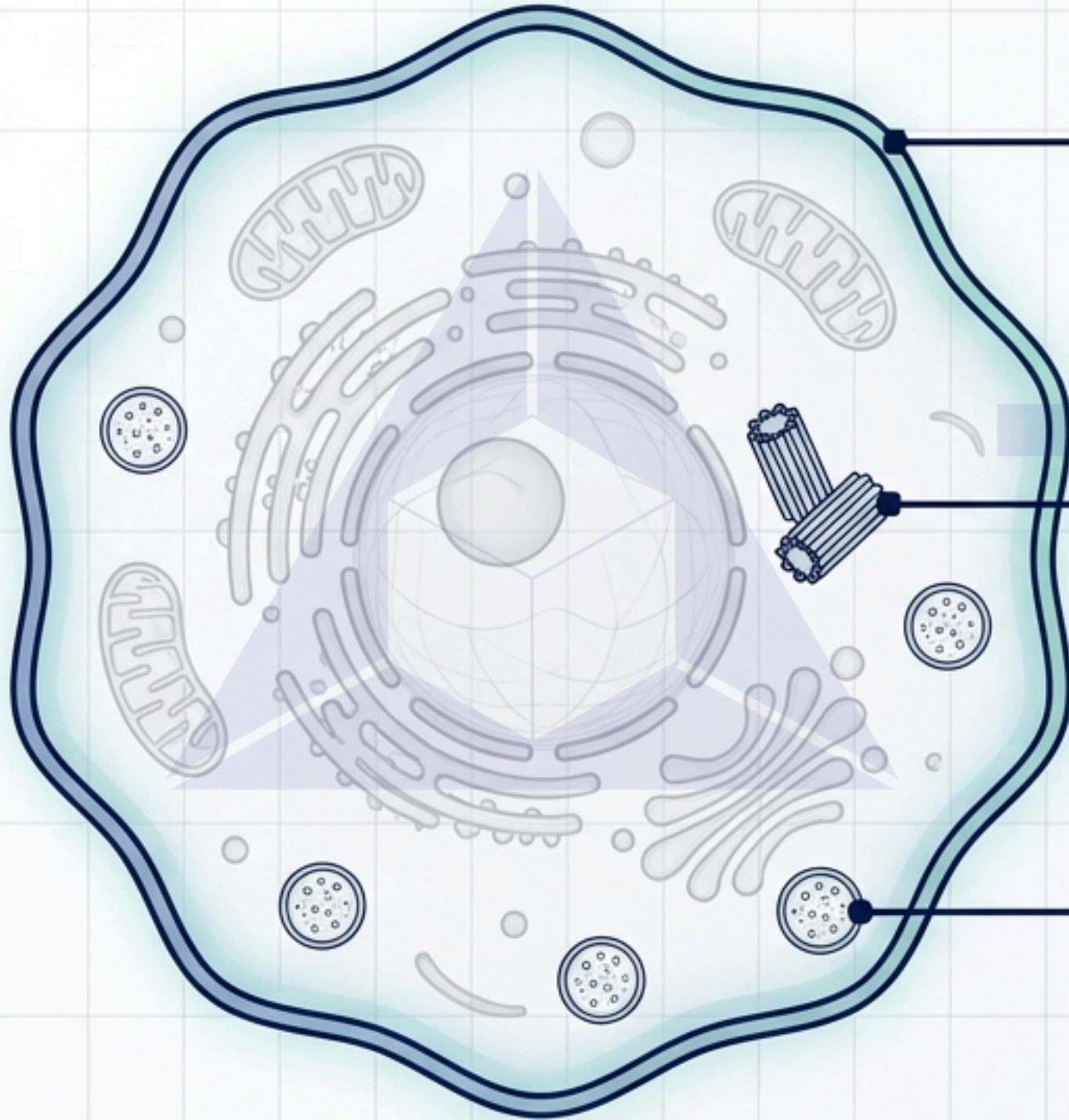
Plastids

Chloroplasts (chlorophyll for photosynthesis), Chromoplasts (carotenoids for color), and Leucoplasts (nutrient storage like starch, oils, or proteins).

Plasmodesmata

Channels traversing the cell wall to connect neighboring cytoplasms.

The Animal Cell Blueprint



Flexible Plasma Membrane

The absence of a rigid cell wall allows for highly varied shapes and cellular motility.

Centrioles (Centrosome)

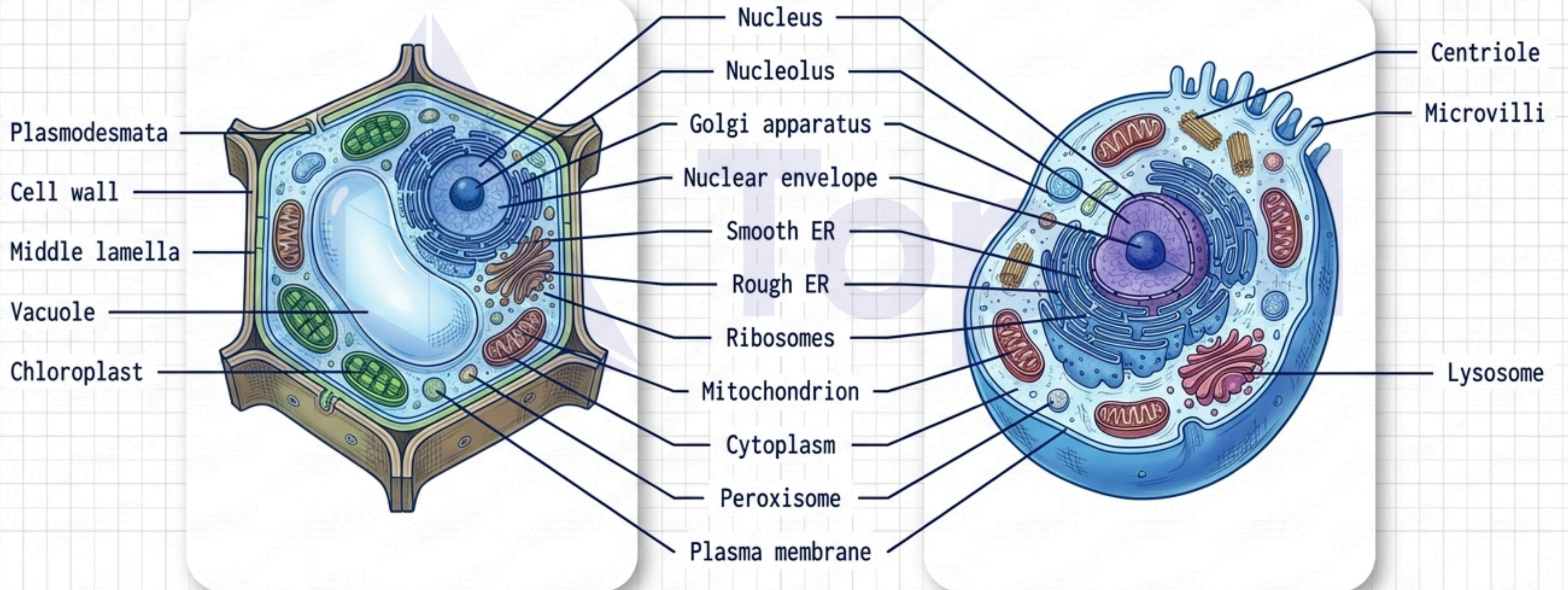
Two perpendicular cylindrical structures (made of 9 evenly spaced tubulin triplets). They form the basal body of cilia/flagella and the spindle apparatus during division.

Lysosomes

Membrane-bound vesicles packaged by the Golgi, uniquely rich in hydrolytic enzymes (lipases, proteases, carbohydrases) optimally active at acidic pH.

Diagnostic Check: Animal cells entirely lack plastids and the large central vacuole characteristic of plant cells.

Diagnostic Blueprint: Structural Comparison





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