

Movement Machines of the Cell

A structural deep dive into Cilia and Flagella.



TopAll

Hair-like Outgrowths of the Cell Membrane

CILIA



Small, highly numerous structures that operate with the sweeping mechanics of oars.

Function:

Causes movement of either the cell itself or the surrounding fluid across the cell surface.

FLAGELLA



Comparatively longer, thicker structures.

Function:

Primarily responsible for the forward, propulsive movement of the entire cell.

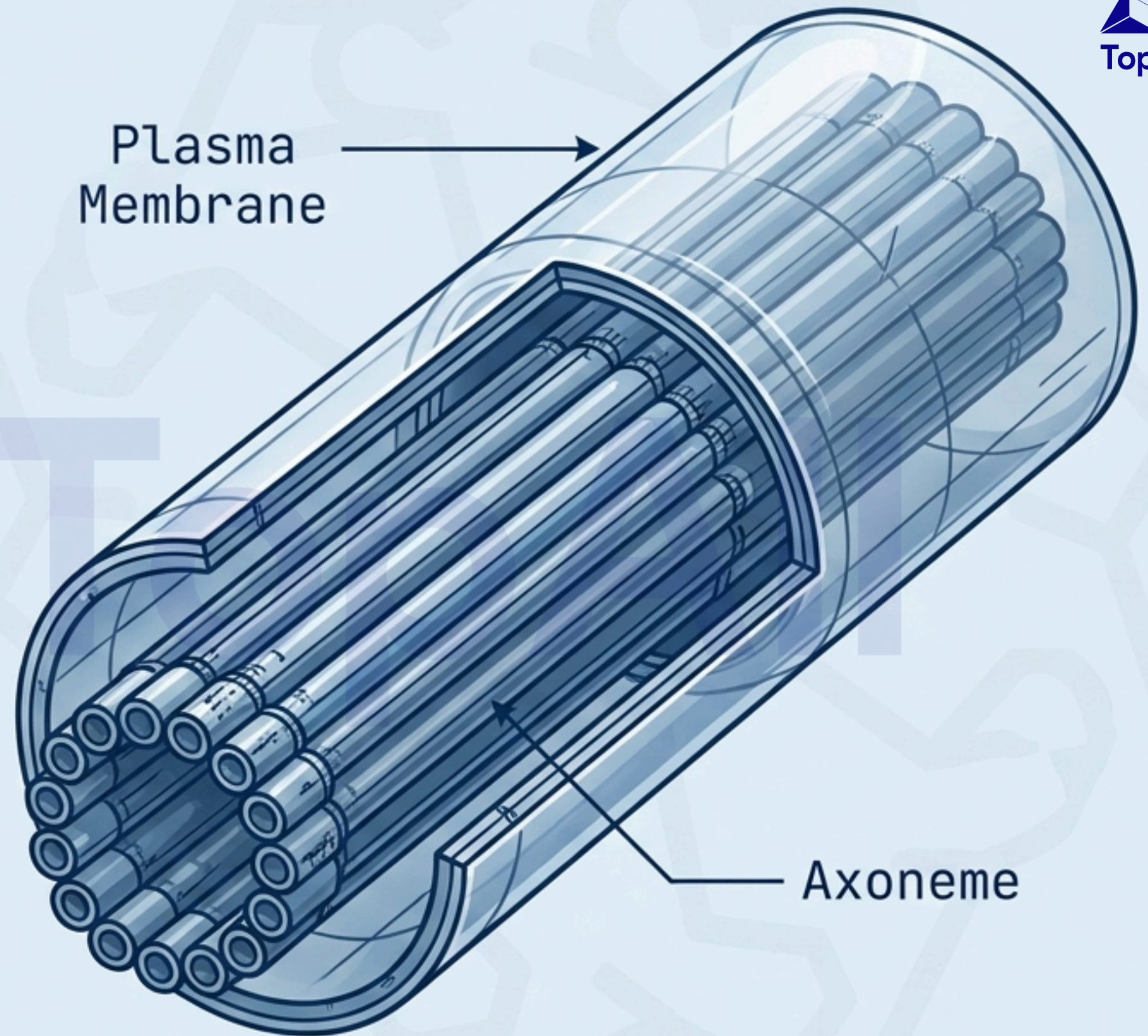
Note: Prokaryotic bacteria also possess flagella, but they are structurally and mechanically distinct from eukaryotic flagella.

The Axoneme: The Core Engine

If you slice open a cilium or flagellum, you find a highly organized core called the Axoneme. It is strictly encased by the plasma membrane and runs parallel to the long axis of the structure.

Key Takeaway

The Axoneme is the universal structural core that powers movement in both cilia and flagella.





You've Learned the Theory. Let's Test Them Now.

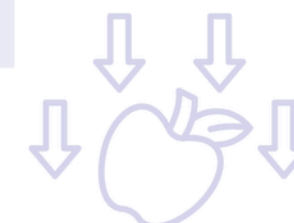
$$E=mc^2$$



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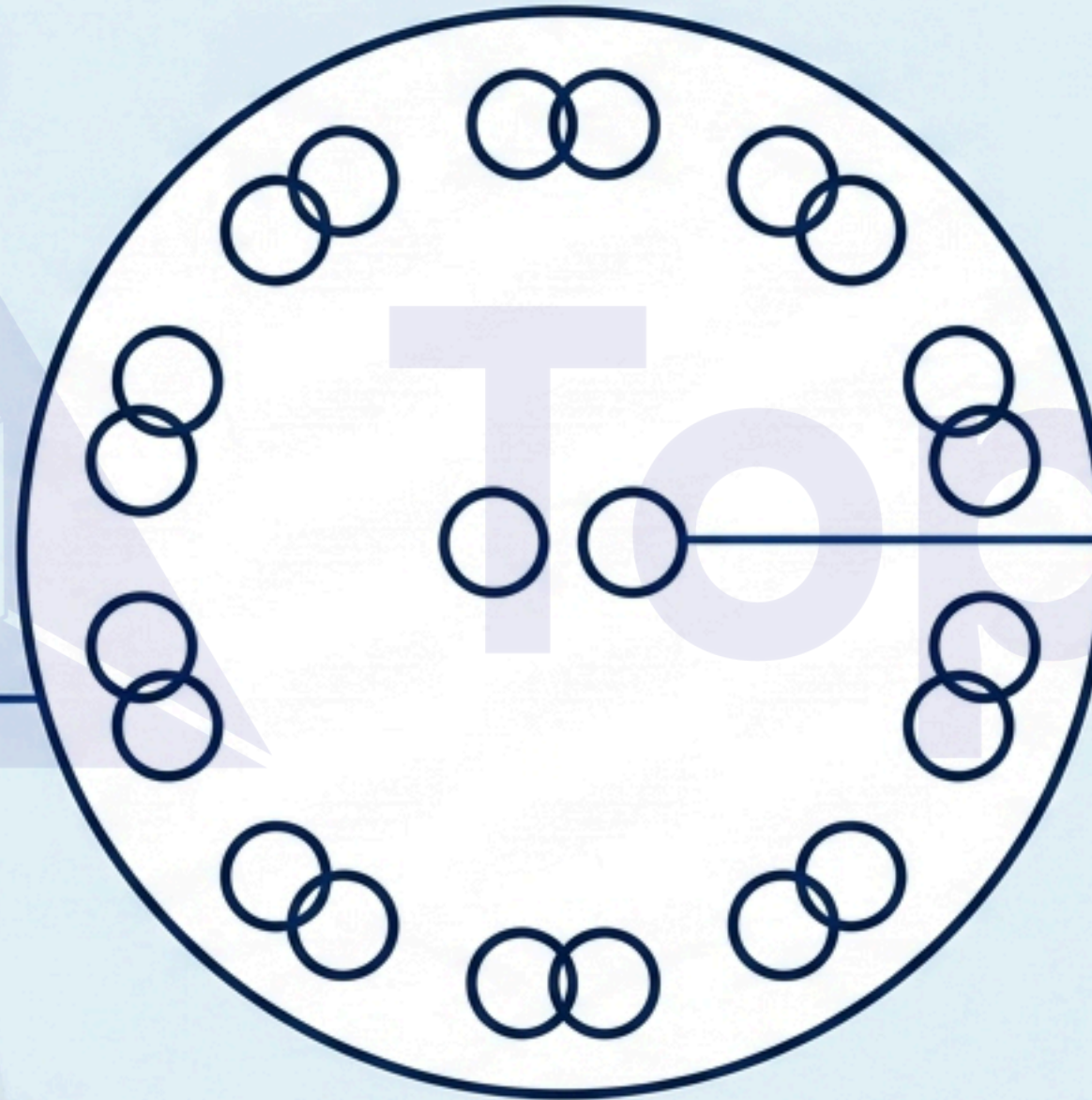
Key Highlights

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The 9+2 Array

Peripheral Microtubules

Nine pairs (doublets) arranged radially around the outside edge.



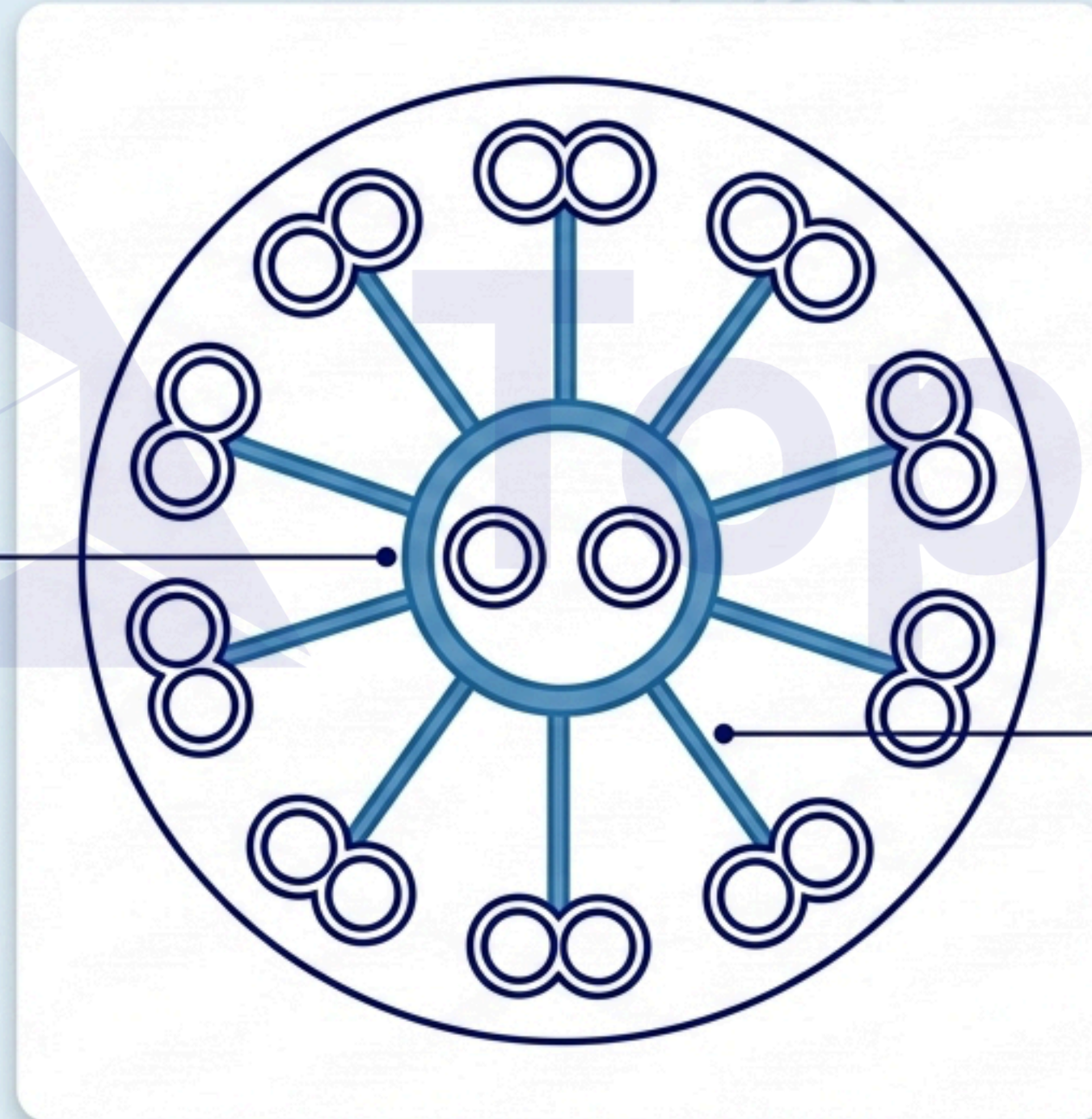
Central Microtubules

A single pair (singlets) located directly in the center axis.

Central Sheath & Radial Spokes

The microtubules do not float freely; they are mechanically tethered to convert sliding forces into bending movement.

Central Sheath:
The protective casing
enclosing the central
pair of tubules.

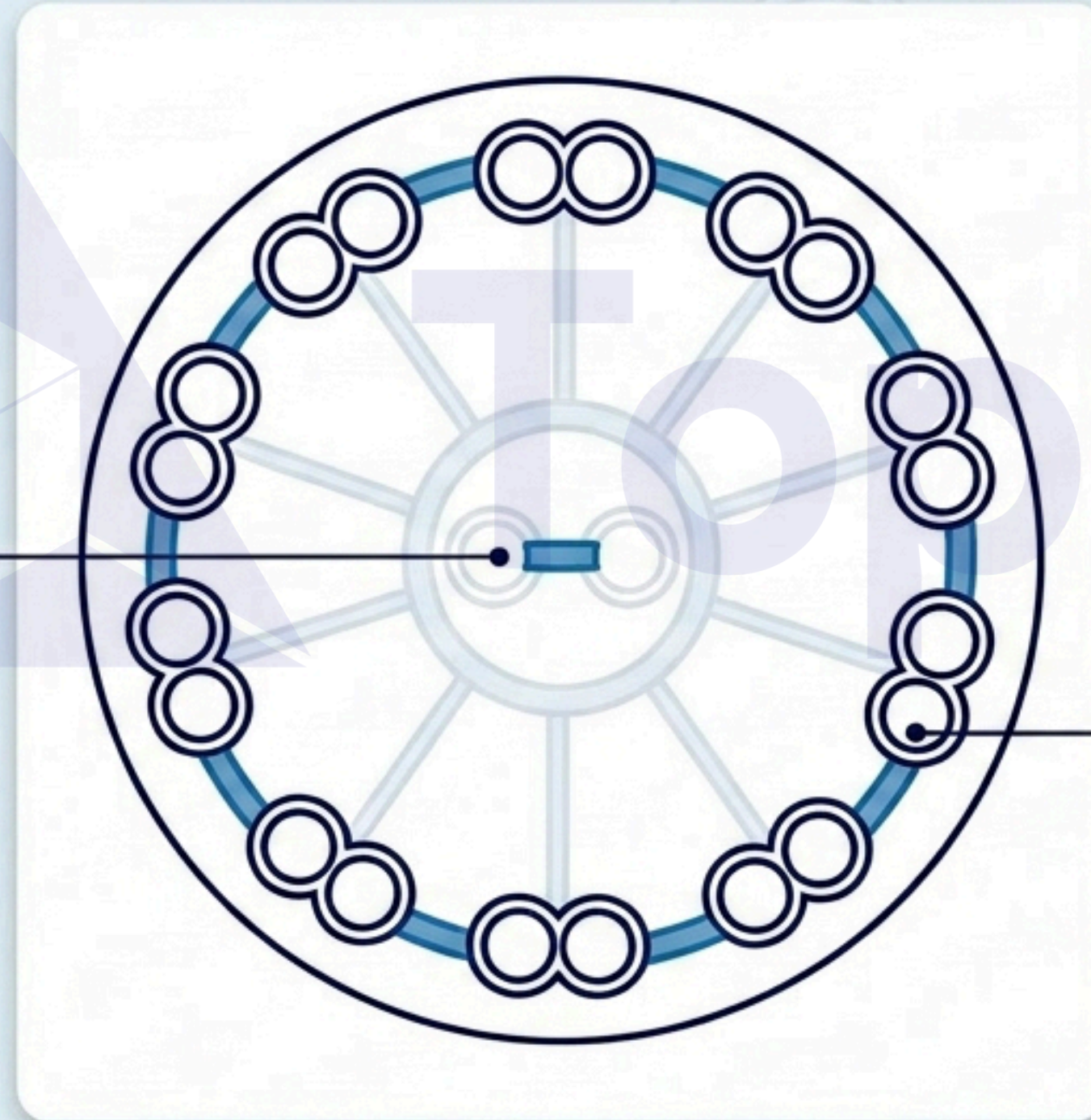


Radial Spoke:
Nine structural connections
linking the central sheath
to one tubule of each
peripheral doublet.

Interconnecting the Periphery

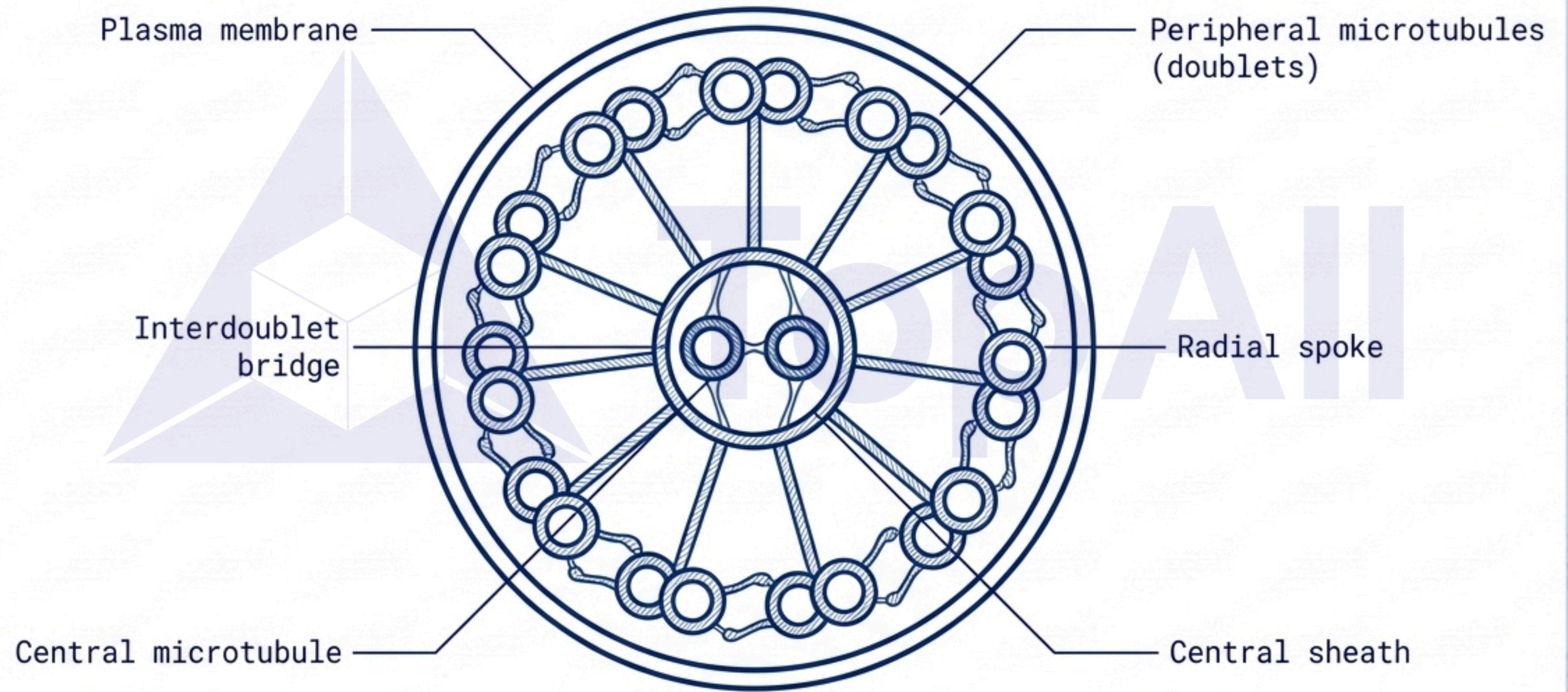
To ensure the entire axoneme bends and flexes as a single coordinated unit, the outer ring features heavy cross-linking.

Interdoublet bridge:
Protein bridges that cross-link the central pair together.



Linkers:
Structural tethers that connect adjacent peripheral doublets to one another around the ring.

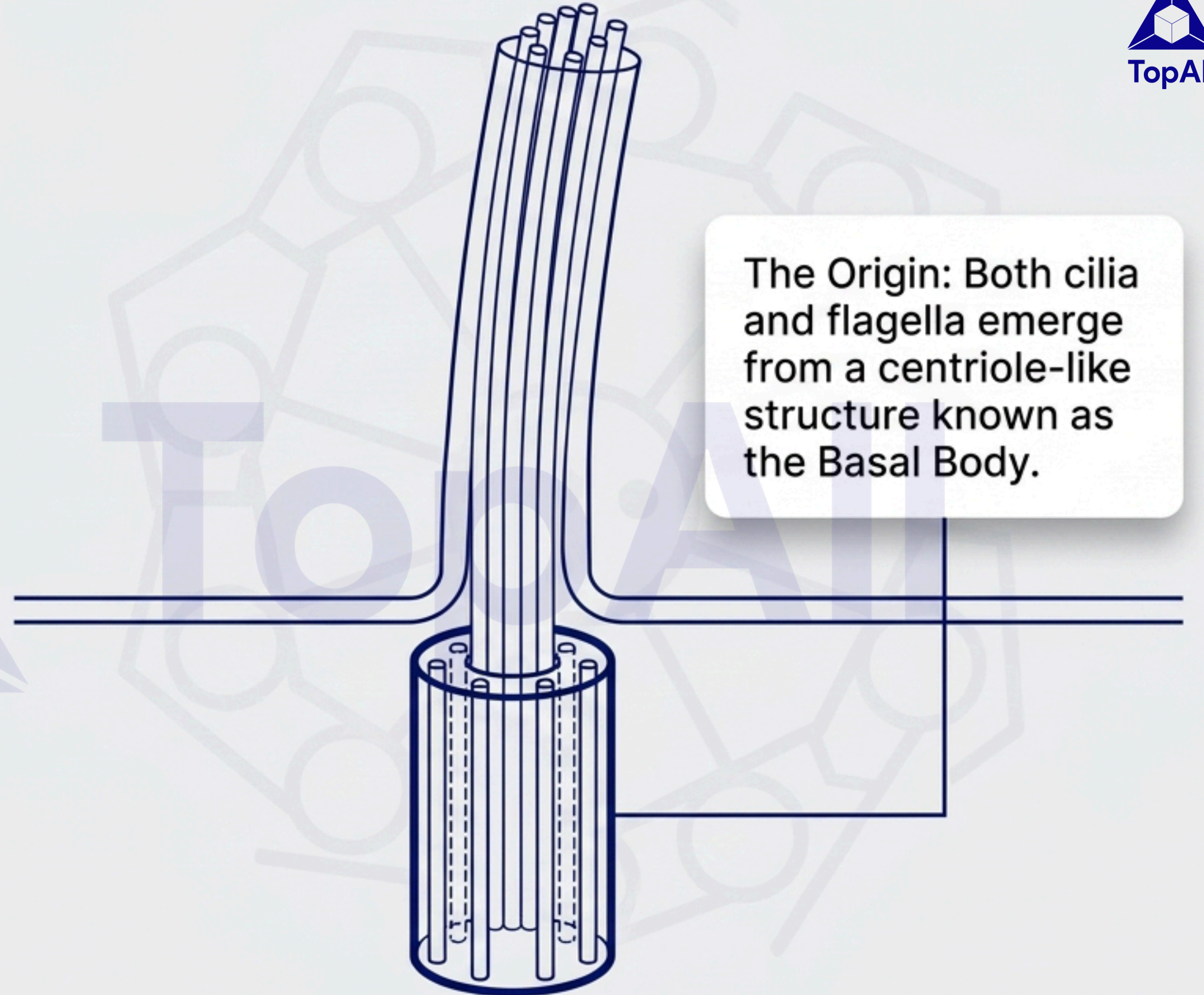
Cross-Sectional Anatomy



Basal Bodies

Neither cilia nor flagella float freely in the extracellular space. To generate kinetic force without detaching, they require a robust anchor inside the cell.

The basal body serves as the foundational anchor and the organizing center for the microtubule array of the axoneme.





You've Learned the Theory.

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