Mystery behind comb jelly movement solved by newly discovered protein

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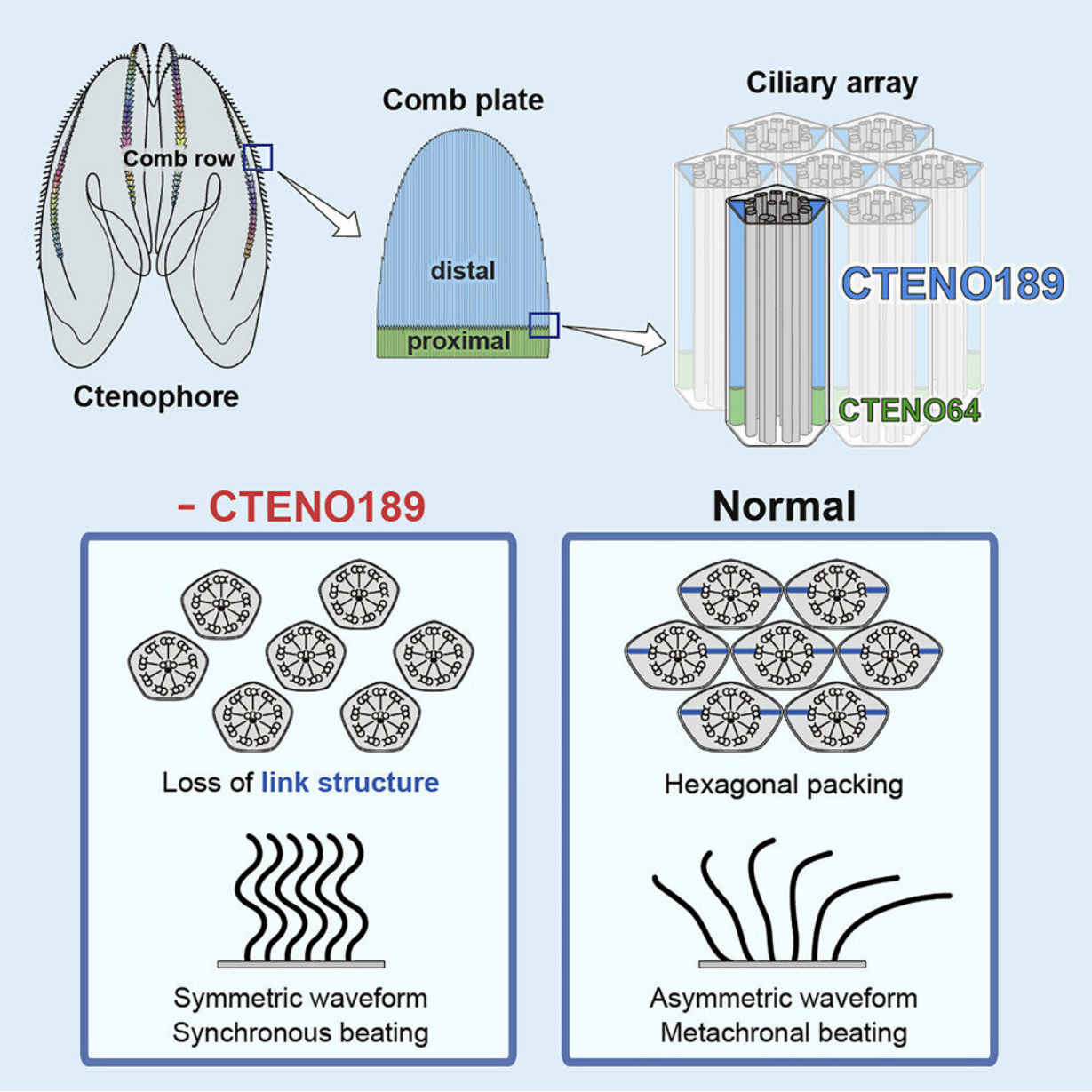

Graphical abstract. Credit: *Current Biology* (2022). DOI: 10.1016/j.cub.2022.09.061

The rainbow of moving lights seen along the sides of comb jellies is one of the most mesmerizing sights in the ocean. Now, researchers from Japan have discovered a protein that controls the movement of these lights, and thus the movement of these distinctive creatures underwater.

In a recent study published in *Current Biology*, researchers from the University of Tsukuba have discovered a protein in comb jellies that is essential to the structure and movement of their comb plates, which are comb-like bodily structures that give these animals their name.

Comb jellies, or ctenophores, are found throughout the oceans, from the surface to the ocean depths. These voracious marine predators are notable for bearing eight rippling bands of bright, iridescent color along their sides. These bands are rows of comb plates that contain tens of thousands of tiny hair-like structures called cilia. Beating of these comb plates propels comb jellies through the water. The coordinated wave-like movement of the cilia scatters surrounding light, which produces a rainbow of colors.

"Cilia are bundled together with structures called compartmenting lamellae (CL)," says author Professor Kazuo Inaba. "These lamellae are thought to be important for the orientation and synchronous movement of cilia. In a previous study, we found a protein, called CTENO64, that is needed for orientation of the cilia, but that's found in only one part of the CL. We still didn't fully understand the overall architecture of the lamellae."

The comb plate is divided into two distinct compartments: proximal and

distal. With the knowledge that CTENO64 is found in the proximal compartment, and to better understand the molecular composition of the CL, the researchers examined whole proteins found throughout the comb plate. They identified those that were both abundant and showed gene expression in only comb plate cells. This search elucidated 21 proteins, including a newly detected protein called CTENO189, which is found in a different region of the CL to that of CTENO64.

"When we knocked out the gene for this new-found protein, the CL did not appear at all in the distal region of the comb plate," explains Professor Inaba. "A closer look at the structure showed that while the comb plates formed normally, the cilia were in disarray and the normal wave-like movement pattern disappeared."

Together, these studies indicate that the two distinct regions of the CL play different roles in controlling the movement of comb jellies. The proximal CL provides a strong building foundation, while the distal CL ensures an elastic connection between cilia. Together, these proteins found in the CL maintain the rippling movement that propels comb jellies through their ocean environment.

More information: Kei Jokura et al, Two distinct compartments of a ctenophore comb plate provide structural and functional integrity for the motility of giant multicilia, *Current Biology* (2022). DOI: 10.1016/j.cub.2022.09.061

Provided by University of Tsukuba