Crystal structure shows how motor protein works

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The crystal structure of the dynamin protein — one of the molecular machines that makes cells work — has been revealed, bringing insights into a class of molecules with a wide influence on health and disease.

"It's a really cool structure," said Jodi Nunnari, professor and chair of molecular and cellular biology at UC Davis and senior author of the paper, to be published Sept. 18 in the journal *Nature*. "This is a really important class of molecules for regulating membrane dynamics."

The detailed structure reveals exactly how the dynamin protein can form large assemblies that pinch off bubbles, or vesicles, from cell membranes. These vesicles allow a cell to "eat" proteins, liquids or other items from the outside, compartmentalize them and move them around within itself.

Marijn Ford, a postdoctoral scholar in Nunnari's laboratory, mapped the crystal structure of dynamin-1 in collaboration with Simon Jenni, a research fellow at Harvard University.

Dynamin belongs to a large family of proteins that, in the right conditions, can self-assemble into larger structures and generate force. Those properties of self-assembly and movement can be harnessed in the cell for different functions.

Dynamin-1 itself is involved in making vesicles in nerve cells at the points where nerves form connections, or synapses, with each other.

Nerve cells communicate through chemical messengers (neurotransmitters) that are released from and taken up by vesicles. Altering the balance of these messengers can affect mental function. For example, an important class of antidepressant drugs works by affecting the uptake of the neurotransmitter serotonin.

The new crystal structure shows exactly how the individual dynamin proteins can line up to form a helix, and then move by ratcheting alongside each other.

It also shows that part of the protein can interact with lipids in cell membranes. That could allow different types of dynamin protein to interact with subtly different types of membrane, specializing their function.

Understanding these miniature motors also might make it possible one day to engineer cells that can do new and different tasks, Nunnari said.

Provided by University of California - Davis

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