Lipid droplets play an unexpected role in embryo development

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New research at the University of Rochester reveals a new role for lipid roles, as well as a fundamental shift in the concept of histone balance.

Histones are proteins needed to assemble DNA molecules into chromosomes. They have long represented a classic balancing act in biology; too few histone molecules result in DNA damage, while too many histones are toxic to the cell. New research at the University of Rochester is causing a fundamental shift in the concept of histone balance and the mechanism behind it.

Previous studies of *Drosophila* embryos showed massive amounts of histones located on lipid droplets, the structures associated with fat storage. While it had been speculated that the lipid droplets provide a place for safe, temporary storage of the histones, scientists had no clear proof for this storage idea nor did they understand how the histones attached to the surface of the droplets.

"What we discovered is that the lipid droplets serve as a holding space, making the histones available for the formation of chromosomes at the precise time they're needed," said Associate Professor of Biology Michael Welte. "We also found that when there are no lipid droplet-bound histones in the embryo, there are problems with the structure of chromosomes that can lead to death."

Welte and his research team were able to come to these conclusions by identifying the protein called "Jabba" as the specific molecule that

anchors histones onto the surface of the lipid droplets.

The other scientists on the research team were Zhihuan Li in Rochester, and Katharina Thiel, Peter Thul, Mathias Beller and Ronald Kühnlein in Germany. Their work will be published next month in the journal Current Biology.

Histones not bound to DNA have long been considered toxic, prompting them to be destroyed by the cells. Welte's work demonstrates that binding to lipid droplets protects the histones, while storing them for later use in chromosome assembly.

Since there is evidence that histones and other proteins are associated with lipid droplets in a variety of organisms, including humans, Welte believes there may be medical relevance in the future.

"We've shown that lipid droplets have a function beyond fat metabolism, and it raises the possibility that, in some cases, fat storage may be beneficial," said Welte. "Additional lipid droplets may allow more toxic proteins to be sequestered, thus protecting the organism."

The next step for Welte and his lab is to determine how Jabba attaches the histones to the lipid droplets and how the binding is regulated. Welte also wants to know if proteins other than histones are being sequestered on the droplets for future use by the *Drosophila* embryo.

Provided by University of Rochester