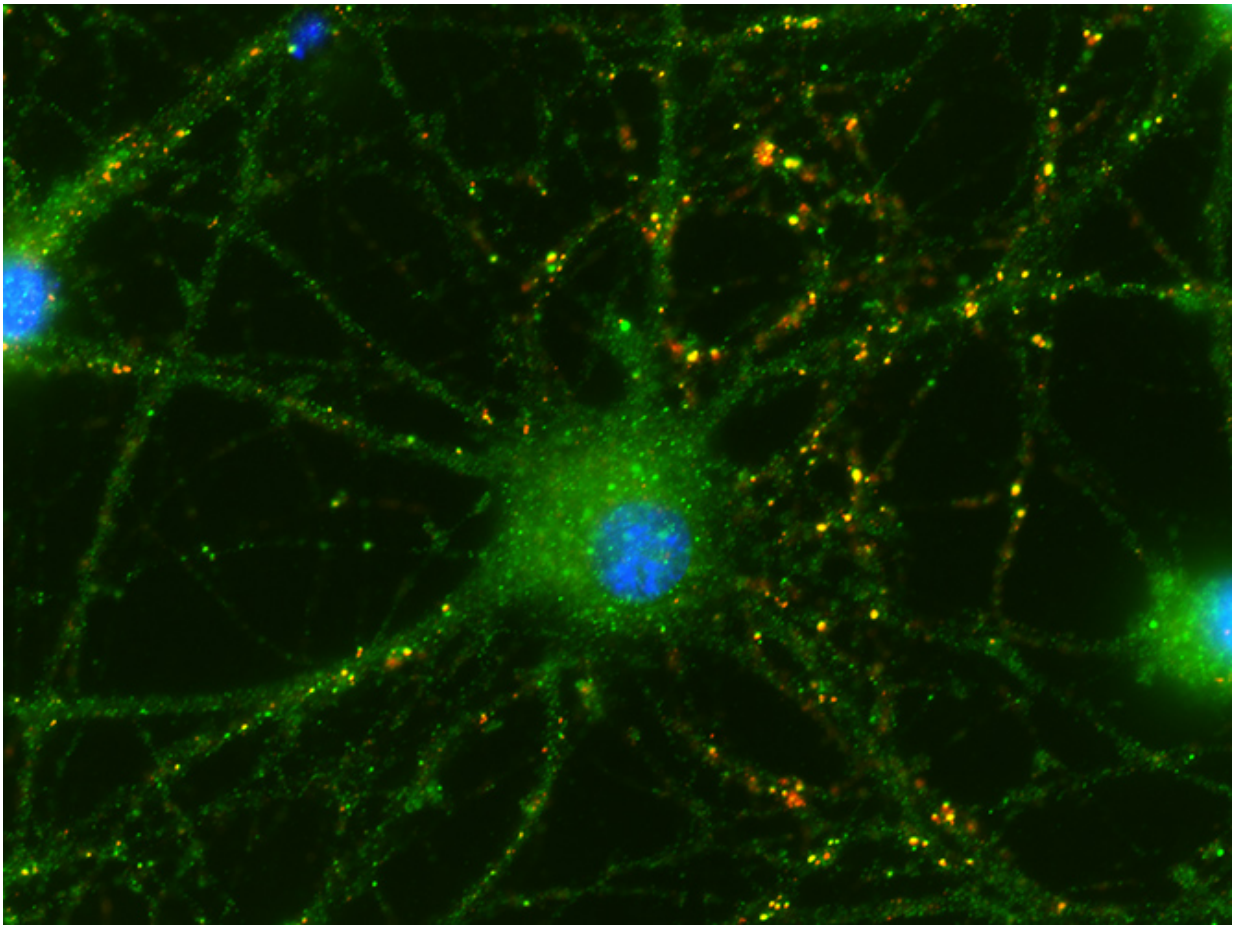
Umbilical cells help eye's neurons connect

November 24 2015



Cells isolated from newborns' umbilical cords help neurons make new connections (shown in yellow) with their neighbors. Credit: Sehwon Koh, Duke University

Cells isolated from human umbilical cord tissue have been shown to

produce molecules that help retinal neurons from the eyes of rats grow, connect and survive, according to Duke University researchers working with Janssen Research & Development, LLC.

The findings, which appear Nov. 25 in the *Journal of Neuroscience*, implicate one family of molecules in particular—thrombospondins—that may have therapeutic potential for the treatment of degenerative eye diseases.

"By learning more about how these cells work, we are one step closer to understanding the disease states in which these cells should be studied," said Cagla Eroglu, an assistant professor of cell biology and neurobiology at the Duke University Medical Center, who led the research.

Umbilical cord tissue-derived cells (hUTC) differ from umbilical cord blood cells in that they are isolated from cord tissue itself, rather than the blood. The Duke team used an established cell culture system to determine whether and how the hUTCs might affect the growth of neurons isolated from the retinas of rat eyes.

In an experimental setup that allowed the two types of cells to bathe in the same fluid without coming into physical contact, retinal neurons in a bath with hUTCs formed new connections between neurons called synapses, and they sprouted new 'neurites'—tiny branches that lead to additional connections.

These cells also survived longer than rat neurons placed in a bath lacking the umbilical cord tissue-derived cells.

Something present in the fluid surrounding the neurons in the bath with the hUTCs was apparently affecting the neurons. Through a series of experiments, the researchers determined that relatively large molecules,

thrombospondin 1, 2 and 4, were primarily responsible for the effect.

Blocking thrombospondins was found to reduce new connections among neurons. By genetically inhibiting the individual members of the thrombospondin family, the researchers found that TSP1, TSP2, and TSP4 in particular were required to create both neurites and new connections.

"It's exciting that thrombospondins had a really strong effect on neurite outgrowth," said Eroglu, who is also a member of the Duke Institute for Brain Sciences (DIBS). She added that making neurites and forming new connections between them are crucial for helping neurons grow when faced with injury and neurodegenerative diseases.

However, blocking TSP1, 2 and 4 did not affect neuron survival, suggesting that there is some other factor in the UTC cells that promotes cell longevity. Her group is now searching for those molecules.

Eroglu's earlier work has shown that thrombospondins are released by brain cells called astrocytes and boost new synapse formation between neurons in the brain.

Eroglu said there may be deficiencies in thrombospondin signaling in neurodegenerative disease, and the group is actively pursuing this hypothesis in animal studies.

More information: "Human Umbilical Tissue-Derived Cells (hUTC) Promote Synapse Formation and Neurite Outgrowth via Thrombospondin Family Proteins," Sehwon Koh, Namsoo Kim, Henry H. Yin, Ian R. Harris, Nadine S. Dejneka, and Cagla Eroglu. *Journal of Neuroscience*, November 25, 2015. DOI: 10.1523/JNEUROSCI.1364-15.2015

Provided by Duke University