Control of cell movement with light accomplished in living organisms

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A precise understanding of cellular growth and movement is the key to developing new treatments for cancer and other disorders caused by dysfunctional cell behavior. Recent breakthroughs in genetic medicine have uncovered how genes control whether cellular proteins are turned 'on' or 'off' at the molecular level, but much remains to be understood about how protein signaling influences cell behavior.

A technique developed in the laboratory of Klaus Hahn, PhD, the Thurman Professor of Pharmacology at the University of North Carolina at Chapel Hill and a member of UNC Lineberger Comprehensive Cancer Center, uses light to manipulate the activity of a protein at precise times and places within a living cell, providing a new tool for scientists who study the fundamentals of protein function.

In a paper published today in the journal Nature Cell Biology, a team led by Denise Montell, PhD, of Johns Hopkins School of Medicine, describes how researchers used the technique, which controls protein behavior in cells and animals simply by shining a focused beam of light on the cells where they want the protein to be active, in live fruit flies.

"This finding complements an additional collaboration with Anna Huttenlocher, PhD of the University of Wisconsin-Madison, published earlier this year in the journal Developmental Cell, showing that this technique could be used to control cell movement in live zebrafish as well," said Hahn.

"We have now shown that this technique works in two different living organisms, providing proof of principle that light can be used to activate a key protein. In this case the protein controls cell movement, enabling us to move cells about in animals. This is particularly valuable in studies where cell movement is the focus of the research, including embryonic development, nerve regeneration and cancer metastasis. Now researchers can control where and where particular proteins are activated in animals, providing a heretofore inaccessible level of control," said Hahn.

The new technology is an advance over previous light-directed methods of cellular control that used toxic wavelengths of light, disrupted the cell membrane or could switch proteins 'on' but not 'off'. Unlike some approaches it requires no injection of cofactors or other unnatural materials into the animals being studied.

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