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Researchers use light to coax cells to move

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(PhysOrg.com) -- Suppose you could get immune cells to move just where you wanted them to in the body - to fight infection or kill a tumor? It may sound like science fiction or magic, but it's not.

Researchers at the University of Wisconsin-Madison have shown that they can make immune cells in living fish embryos move the way they want them to, simply by shining a focused beam of light on them from their microscope.

Published recently in *Developmental Cell*, the study was done to visualize the dynamics of cell movement. The experiments also showed that a signaling protein called PI(3)K is essential in two ways for cells to move.

Though no one can say for sure yet, some scientists can imagine astonishing future clinical possibilities for the remotely activated cell-moving ability.

"Could you move immune cells to wounds to help fight infections?" says lead author Dr. Anna Huttenlocher of the UW School of Medicine and Public Health. "Could you control the movement of T-cells to kill tumors? Could you remove inflammation-causing cells from arthritic hands?"

It's pie in the sky, but very intriguing, says Huttenlocher, a professor of medical microbiology and immunology and of pediatrics.

The goal of the study was to understand how immune cells called

leukocytes travel to inflammation sites, and what signaling mechanisms are involved.

Huttenlocher, a physician investigator who sees patients with chronic inflammation at American Family Children's Hospital, uses zebrafish embryos in her studies on cell migration. Individual cells inside the transparent embryos are visible with a high-powered confocal microscope.

The UW-Madison team concentrated on PI(3)K because it is a critical regulator of many cellular processes, including cell migration. It's thought to activate another protein called Rac, which then causes the front edge of some cells to protrude before the back end of the cell inches forward. However, there have been conflicting reports on PI(3)K's exact role in the process.

Huttenlocher and her team used a tool developed by a University of North Carolina collaborator, who showed in test tube studies that he could induce cell movement. The tool uses a light beam to activate cells that have been tagged with a substance that responds to light by becoming fluorescent.

With a spotlight on them, cells containing Rac not only glowed, they also moved.

"The light turned on the Rac, which activated the leading edge of the cell to protrude," Huttenlocher says.

Using the light beam, Sa Kan Yoo, a graduate student in the lab, controlled exactly where the cells would go, even guiding them to align themselves to spell out the letters RAC.

"If you activate Rac at the leading edge of a cell, you can control where

it goes," Huttenlocher says.

The researchers found that PI(3)-K was active in the process in two different ways. It first signaled Rac to move the front of the immune cell forward and then signaled the back side to follow, like a crawling inch worm.

"We've shown that PI3-K is probably even more important in this migration process than scientists had suspected," says Huttenlocher.

Knowing how and where the protein works may help in the development of therapeutic drugs.

"Since we now know movement begins with activity at the front edge of the cell, we can look deeper into the signaling pathways involved there and search for targets that could enhance or inhibit the process," she says.

Provided by University of Wisconsin-Madison