New Membrane Lipid Measuring Technique May Help Fight Disease

EurekAlert

Could controlling cell-membrane fat play a key role in turning off disease?

Researchers at the University of Illinois at Chicago think so, and a biosensor they've created that measures membrane lipid levels may open up new pathways to disease treatment.

Wonhwa Cho, distinguished professor of chemistry, and his coworkers engineered a way to modify proteins to fluoresce and act as sensors for lipid levels.

Their findings are reported in *Nature Chemistry*, online on Oct. 9.

"Lipid molecules on cell membranes can act as switches that turn on or off protein-protein interactions affecting all cellular processes, including those associated with disease," says Cho. "While the exact mechanism is still unknown, our hypothesis is that lipid molecules serve sort of like a sliding switch."

Cho said once lipid concentrations reach a certain threshold, they trigger reactions, including disease-fighting immune responses. Quantifying lipid membrane concentration in a living cell and studying its location in real time can provide a powerful tool for understanding and developing new ways to combat a range of maladies from inflammation, cancer and diabetes to metabolic diseases.

"It's not just the presence of lipid, but the number of lipid molecules that are important for turning on and off biological activity," said Cho.

While visualizing lipid molecules with fluorescent proteins isn't new, Cho's technique allows quantification by using a hybrid protein molecule that fluoresces only when it binds specific lipids. His lab worked with a lipid known as PIP2 -- an important fat molecule involved in many cellular processes. Cho's sensor binds to PIP2 and gives a clear signal that can be quantified through a fluorescent microscope.

The result is the first successful quantification of membrane lipids in a living cell in real time.

"We had to engineer the protein in such a way to make it very stable, behave well, and specifically recognizes a particular lipid," Cho said. He has been working on the technique for about a decade, overcoming technical obstacles only about three years ago.

Cho hopes now to create a tool kit of biosensors to quantify most, if not all lipids.

"We'd like to be able to measure multiple lipids, simultaneously," he said. "It would give us a snapshot of all the processes being regulated by the different lipids inside a cell."

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