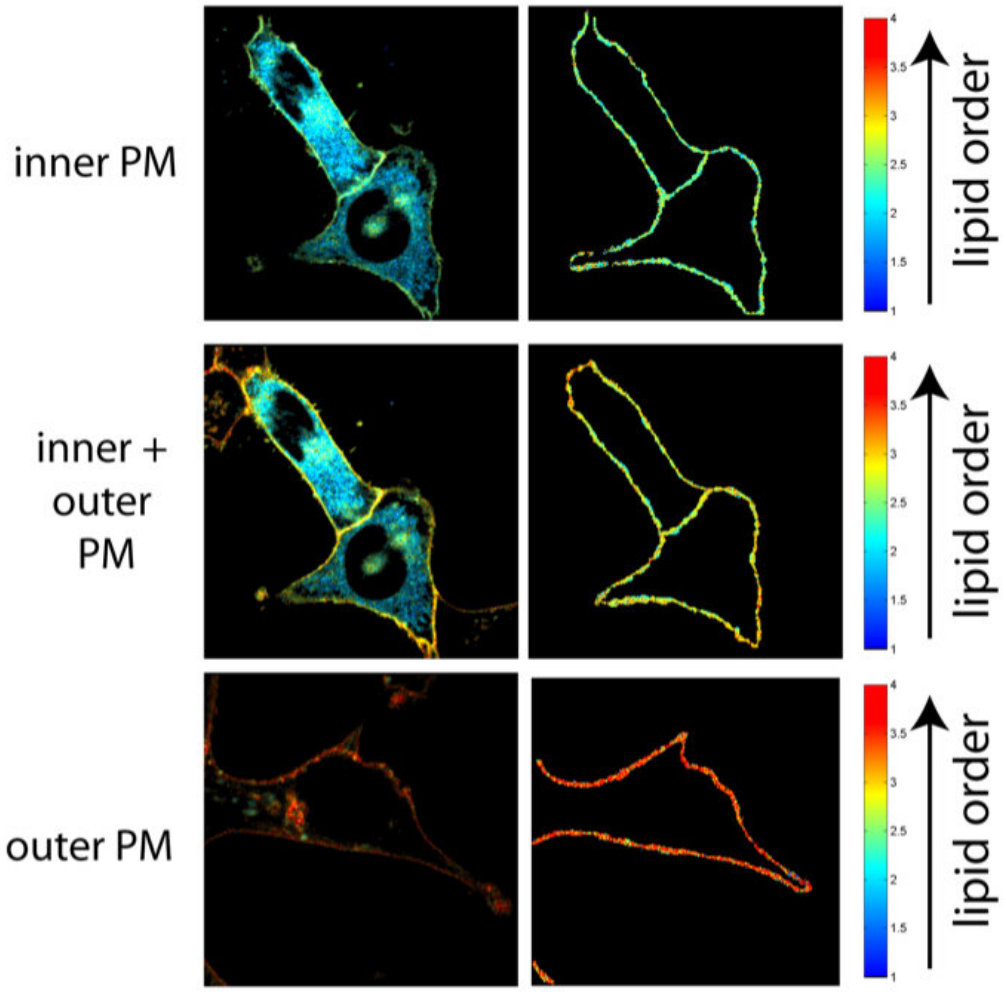
'Lipid asymmetry' plays key role in activating immune cells

February 20 2018



A cell's membrane is composed of a bilayer of lipids, and the inside-facing layer

is made of different lipids than the outside-facing layer; the differences in membrane order between the inside and outside bilayer are both obvious and striking. Credit: Joseph Lorent

A cell's membrane is its natural barrier between the inside of a cell and the outside world—composed of a double layer (bilayer) of lipids (such as fats, waxes, sterols, or fat-soluble vitamins). Intriguingly, it's been known for decades that the layer facing the inside of cells is made of different lipids than the outside-facing layer.

This "lipid asymmetry," or lack of symmetry, is regulated via a variety of proteins and demands a high amount of energy from the cell. Since the cell invests resources toward keeping the lipids asymmetrically distributed equally between the two sides of the bilayer, the process is vital to its function. Dying cells, which permanently lose their lipid asymmetry, are targeted by the immune system for elimination.

Because different lipids create membranes with different physical properties, a group of McGovern Medical School researchers wondered whether different lipid compositions in the bilayer could also lead to different physical properties.

During the 62nd Biophysical Society Annual Meeting, held Feb. 17-21, in San Francisco, California, Joseph H. Lorent, a postdoctoral researcher, and Ilya Levental, an assistant professor, will present their work exploring lipid asymmetry's role in immune cell activation.

A variety of fluorescent probes can provide insights about the general physical properties of membranes. But these probes tend to stain both sides of the plasma membrane—making it impossible to independently measure the two layers of the bilayer.

"To overcome it, we use a trick where we inject the probe directly inside single cells using a tiny glass syringe like the kind used for extracting nuclei out of cells for cloning," Lorent said. "This allows us to visualize specifically half of the membrane facing the [inside of the cell]."

Now the researchers could see the changes between the inside and outside bilayer. "The differences were obvious and striking," Lorent said. "By preventing the loss of membrane asymmetry, we inhibited the immune response."

The team found that adjusting the lipid asymmetry of the membrane was important to the immune cells functioning. "In the long run, by knowing how lipid asymmetry is involved in cell signaling, we might be able to 'tune' certain immune responses or even cell death through the regulation of lipid asymmetry," Levental said. "This might involve treatments for allergies, inflammation or possibly even cancer."

More information: 1873-Plat - "Structural determinants and functional consequences of protein association with membrane domains" is authored by Joseph Lorent, Blanca Barbara Diaz-Rohrer, Xubo Lin, Alex Gorfe, Kandice R. Levental and Ilya Levental. It will be presented on Tuesday, Feb. 20, 2018, in South, Level Two, Room 215-216 of the Moscone Center, South. Abstract: plan.core-apps.com/bpsam2018/a … 1290aae09439cc3f6e68

Provided by Biophysical Society