What is this research about?
Cell membranes are the thin outer shells of animal cells; they have many functions, which include allowing substances to move in and out of the cell. Cell membranes consist mainly of many types of phospholipids (fats), and different proteins that resemble icebergs "floating" in the "sea" of fats.

To understand how cell membranes and their proteins work, researchers often study simple model systems of two or three phospholipids. In particular, scientists often need to study the phase behaviour of these systems. Phase behaviour refers to how a cell membrane responds to changing temperatures – which make the lipids more solid ("gel phase") or more fluid ("liquid disordered phase"). The gel phase has features called "fibril domains" and "patch domains", whereas the fluid phase does not. Chemicals called "fluorescent probes" associate with certain types of fats and cause these fats to glow under a microscope when exposed to fluorescent light.

This allows scientists to see the structure of the particular lipid system. Some probes associate better with gel phase fats, while others associate better with fluid phase fats, making it important to choose the right probe.

The purpose of this research was to find out how various fluorescent probes distribute between the gel and fluid phases of cell membrane fats.

What you need to know:
Fluorescent probes can help scientists understand what cell membranes are made of and how they behave. Since some probes act differently with different model systems of cell membranes, and also in the presence of other probes, scientists need to choose probes carefully.

How can you use this research?
Cell biologists can use this research to figure out which fluorescent probe is best suited to use with their cell membrane model system.

Designers of scientific tools and instruments can use this research to create better guidelines for scientists on the use of fluorescent probes.

Keywords:
Cell membrane, phospholipids, fluorescent probes, imaging method, phase transition, lab equipment
What did the researchers do?
The researchers created mixtures of two fats with different fluidity (40% DOPC, 60% DPPC). To each sample they added either a single type of fluorescent probe, two different probes, or three different probes. Six different fluorescent probes were used in total.

An electric current was then passed through the DOPC/DPPC/probe(s) mixture to form large hollow vesicles (like balloons), enclosed by a fat membrane. After heating to 42°C, the samples were allowed to cool and then viewed under a fluorescence microscope at regular intervals.

During viewing, different colours of light were passed through each sample. Each probe had a specific colour range that caused it to glow.

What did the researchers find?
One of the six probes, NBD-DPPE, marked the “fibril domains” in the gel phase, while the other five probes marked the fats in the liquid disordered phase.

One of the probes, TR-DPPE, reliably labelled the liquid disordered phase in the fat vesicles whether used alone, or with one or two other probes. None were able to mark the “patch domains” in the gel phase.

When the Rh-DPPE probe was present, the behaviour of the other probes and the fats was seriously affected.

About the University of Guelph researchers:
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