Method and compositions for the efficient replacement of endogenous live cell plasma membrane lipids with select lipids

This lipid exchange method will enable a much wider range of studies of membrane lipid function and organization than heretofore possible.

Background
The lack of tools and methods to manipulate membrane lipid composition in live cells has hindered our ability to understand the function of lipids in membranes surrounding cells and their internal compartments. Pharmacological inhibition of lipid synthesis remains the most widely used approach to manipulate cell membrane lipids. These methods are slow to act and are only available for a few classes of lipids and induce changes in multiple lipid species. In addition it is difficult to target many lipid species, alter just a single type of lipid, alter lipid acyl chain structure independently of lipid headgroup structure, or introduce novel and/or unnatural lipid species through this approach. Alternatively, lipid substitution holds a promising approach to solving these issues, however until now, these methods have been primarily limited to model membranes. The development of methods to efficiently exchange phosphor- and sphingolipids in cells has the potential to transform research related to lipid membrane function by allowing the manipulation of cell lipids over a wide range, including introduction of unnatural lipids or modified lipids.

Technology
Dr. Erwin London of the Department of Biochemistry and Cell biology has developed a method to use certain cyclodextrins to replace the phospholipids and sphingolipids in the outer leaflet of the plasma membrane of a living mammalian cell, with exogenous lipids with a high degree of efficiency. The method includes the replacement of cellular lipids including pure phosphatidylcholines, including palmitoyl oleoyl phosphatidylcholine, as well as sphingolipids from egg, mammalian brain or milk, using cyclodextrin.

Patent number/Publication:
Provisional patent pending covering methods and compositions.
Manuscript in preparation

Advantages
- Efficient lipid exchange without damaging cells
- Targets wide lipid species or single lipid species
- Enables altering lipid structure within cell.
- Enables introduction of novel or unnatural lipids

Applications
- To study lipid function and physical properties in live cells

Sean Boykevisch, PhD
Assistant Director
Office of Technology Licensing and Industry Relations
N5002 Melville Library
Stony Brook University
Stony Brook, NY 11794-3369
631-632-6952
Sean.Boykevisch@stonybrook.edu
www.stonybrook.edu/research/otlir

Stony Brook University
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