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Biosynthesis of Deuterated Lipids for Characterization of Biomembranes and Membrane Proteins

Membrane proteins play crucial roles in many cellular processes, however, studying membrane proteins is challenging because of their complex structure and fragility when isolated from their native environment. One solution is to embed membrane proteins in a membrane-mimic to provide a more native environment to facilitate their characterization. Small-angle neutron scattering (SANS) is an ideal technique to obtain structural information on biomacromolecules under physiologically relevant conditions. With this technique, deuterated phospholipids need be used to suppress their 1H signal in SANS measurements. In this study, we report on producing deuterated phosphatidylethanolamine (PE) by extraction and fractionation from native Escherichia coli extracts, and phosphatidylcholine (PC) from an engineered E. coli strain. The regiospecific deuterium incorporation of PC can be controlled by growth conditions. The isolated PC product was confirmed by 1 H Nuclear Magnetic Resonance (NMR) and Liquid Chromatography - Mass Spectrometry (LC-MS) was used as a complementary tool for SANS to predict deuteration levels. These materials can be used for neutron scattering studies with micelles, bicelles, liposomes, styrene-maleic acid lipid particles (SMALPs), and Membrane Scaffold Protein (MSP)-based lipid nanodiscs to produce a membrane-mimicking environment for studying membrane proteins, and can be used for lipid studies using NMR as well.

Topical Area

Biology and life sciences

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