Insights into the Formation and Future Applications of PSI-SMALP

Nathan Brady
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## Thylakoid Membrane Lipids

<table>
<thead>
<tr>
<th>Lipid Name</th>
<th>Preferred Morphology</th>
<th>Net Charge</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>51%</strong> Monogalactosyldiacylglycerol (MGDG)</td>
<td>H_{II} (cubic)</td>
<td>0</td>
<td><img src="structure1.png" alt="Structure" /></td>
</tr>
<tr>
<td><strong>21%</strong> Phosphatidylglycerol (PG)</td>
<td>Lamellar</td>
<td>-1</td>
<td><img src="structure2.png" alt="Structure" /></td>
</tr>
<tr>
<td><strong>14%</strong> Digalactosyldiacylglycerol (DGDG)</td>
<td>Lamellar</td>
<td>0</td>
<td><img src="structure3.png" alt="Structure" /></td>
</tr>
<tr>
<td><strong>14%</strong> Sulfoquinovosyldiacylglycerol (SL)</td>
<td>H_{II} (cubic)</td>
<td>-1</td>
<td><img src="structure4.png" alt="Structure" /></td>
</tr>
</tbody>
</table>

Lipo-protein complex is ~30% larger in SMALP compared to DDM

77K chlorophyll florescence red shifted in PSI-SMALP compared to PSI-DDM

Characterization of a Photosystem I SMALP

FIGURE 3

DDM SMALP

Nathan G. Brady et al. October 2019. RSC Advances.
Charge separation occurs 1,000 fold faster in ~45% of PSI-SMALPs compared to PSI-DDM.

~45 % of PSI-SMALP particles show an ultrafast charge separation event that is disrupted during detergent isolation.

Light to electricity via Applied Photosynthesis

Light Energy Applied Photosynthetic (LEAPh) System

Potential Applications

- Solar energy conversion
- Optical sensors
- Laser guided systems
- Light intensity detectors
- Photon counting devices
What is the mechanism driving SMALP formation?
SMA 1440: A unique SMA for a peculiar membrane

Collapsed SMA free in solution exhibits prolate ellipsoidal geometry by SAXS

Butoxyethanol functionalization increases hydrophobicity and surface activity of SMA 1440

Neutron and X-ray reflectometry allow us to observe the initial insertion event in detail.
Elastic modulus of galactolipid rich monolayers shows transitions at higher pressure compared to phospholipid monolayers.
XRR shows galactolipid-rich membranes start thinner and become thicker after addition of SMA.
NR suggests deeper insertion of butoxyethanol into acyl region for galactolipid-rich monolayers

Thank you!

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