Significance and Impact
Neutron diffraction will reveal explicit hydrogen bonding interactions between protein and pigments in antenna complexes of i) LH2 (Cogdell lab) and ii) FMO (Blankenship lab)

Research Details

Obtained new crystal forms of paFMO that are suitable for neutron diffraction (with Blankenship lab)

The 1.3 Å X-ray structure of the new H3 crystal form shows that two structurally distinct Apo and ~35% 8th BCL bound FMO conformers co-exist in the asymmetric unit.

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<th>xtal9</th>
<th>xtal5M</th>
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<tbody>
<tr>
<td>Monomer</td>
<td>A</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>8th BCL (%)</td>
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<td>~25</td>
<td>~15</td>
</tr>
<tr>
<td>Res (Å)</td>
<td>1.35</td>
<td>1.55</td>
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Fig 1. Apo and ~35% 8th BCL bound forms

Fig 2. Overlay of Apo and 8th BCL bound forms
Scientific Achievement
Neutron scattering reveals changes in thylakoid membrane stiffness that accompany the re-arrangement of photosynthetic membrane layers as cyanobacteria respond to changes in illumination.

Significance and Impact
Neutron Spin Echo spectroscopy (NSE) is uniquely able to measure the dynamics of biological membranes in vivo in response to changing environmental conditions that are crucial for understanding biological light harvesting and photosynthetic productivity.

Research Details
- NSE provides dynamics information specific to selected length scales and we therefore can explicitly attribute the observed changes in relaxation constants to the relative motion of the membranes, including changes in the thylakoid lumenal space.
- NSE observed increased stiffness of the bilayer membrane in response to light, apparently correlating with swelling of the lumenal space. A planned repeat of the experiment in the presence of a photosynthetic electron transfer inhibitor shall further corroborate the tie of membrane stiffness to the process of photosynthesis.

Fig.1 Relaxation rate $\Gamma$ as a function of $q$ from NSE measurements shows variation between dark and light states that could be correlated with the photosynthetic process.