SFB 1078

Protonation Dynamics in Protein Function

Colloquium

Mon, June 17, 2019

15:15 – 17:30

Freie Universität Berlin
Physics Department
Lecture Hall B

(Arnimallee 14, 14195 Berlin-Dahlem)

Prof. Karin Busch – Westfälische Wilhelms-Universität Münster

pH Sensors in respiring mitochondria report different pH gradients

The activity of mitochondrial complexes CI, CIII and CIV generates a proton gradient across the inner mitochondrial membrane. This gradient is an electrochemical gradient consisting of a membrane potential DY_m, and a chemical H^+ gradient and constitutes the so-called proton motive force (*pmf*). The *pmf* is used to drive ATP synthesis by complex V. The pH gradient across the inner membrane is often equated with the difference in H+ concentration between cytosol and matrix. This is probably mainly due to experimental limitations but much too simple, since it neglects several facts and observations discussed in the community: the intracrisis space differs from the intermembrane space [1], probably there is a proton layer on lipid surfaces that is not in equilibrium with the bulk [2] and, as we have reported, even a lateral DpH can be measured between a primary proton pump and a secondary proton pump on the same side of the membrane [3]. By means of pH-sensitive fluorescent reporters localized at different positions in mitochondrial compartments, we found now even more pH gradients including lateral, radial and transmembrane gradients. Most surprisingly, the measured DpH at CV was almost negligible in respiring mitochondria. Furthermore, we found that metabolic conditions influence the pH gradients across the membrane and between surface and bulk. Our data show that lateral pH gradients at the p-side of the inner membrane can be reversed, resulting also in changed transmembrane and radial pH gradients depending on the metabolic state. In sum, the *pmf* is a highly variable measure with local differences.

[1] Proc Natl Acad Sci U S A, 2015. **112**(1): p. 130-5.
[2] Biochim Biophys Acta, 2006. **1757**(8): p. 913-30.
[3] Nat Commun, 2014. **5**: p. 3103.

Dr. Dennis Nürnberg – Freie Universität Berlin

Oxygenic photosynthesis at its energy limit: Membranes and proteins for growth in the infrared

Oxygenic photosynthesis uses chlorophyll a to convert solar energy into the chemical energy that drives the biosphere. Chlorophyll a absorbs visible light only up to ~700 nm, the so-called “red limit”. When deeply shaded by other photosynthetic species, some cyanobacteria are able to extend this limit by using modified chlorophylls. Chlorophyll f, is the longest wavelength and most recently discovered chlorophyll but it is assumed to play a purely light harvesting role. When the cyanobacterium Chroococcidiopsis thermalis is grown in far-red light it forms around 10% chlorophyll f in addition to chlorophyll a. Here, we investigated the effect of far-red light on the remodelling of membranes, photosystems and the phycobilisome complexes using various spectroscopic, microscopical and biophysical methods. We show the presence of (i) a highly efficient photosynthetic system with chlorophyll f as the primary electron donor in both photosystems, PSI and PSII, (ii) densely packed thylakoid membranes with phycobilisome complexes strongly reduced in quantity and size, (iii) highly oligomerised photosynthetic complexes of PSI, and (iv) the formation of bioenergetic membrane domains. The findings provide important new insights into the mechanism of light acclimation and the limits of oxygenic photosynthesis.

Coffee and tea are ready at 15:00 and during the break from 16:15 – 16:30. www.sfb1078.de

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