3rd Baltic Biophysics Conference, October 6-7th, Vilnius

Regulating light harvesting in oxygenic photosynthesis

Herbert van Amerongen[1,2]

[1]Laboratory of Biophysics, Wageningen University, Stippeneng 4, Wageningen, The Netherlands.
[2]MicroSpectroscopy Research Facility, Wageningen University, Stippeneng 4, Wageningen, The Netherlands.
herbert.vanamerongen@wur.nl

Photosynthetic organisms are crucial for life on Earth as they provide food and oxygen and are at the basis of most energy resources. They have a large variety of light-harvesting strategies that allow them to live nearly everywhere where sunlight can penetrate. They have adapted their pigmentation to the spectral composition of light in their habitat, they acclimate to slowly varying light intensities and they rapidly respond to fast changes in light quality and quantity. These regulatory processes are particularly important for oxygen-producing organisms because an overdose of light in combination with oxygen can be lethal [1]. The study of light harvesting and its regulation is not only a fascinating research field in itself, it will hopefully also provide the knowledge that is required for optimizing light harvesting in algae and plants to improve light-driven production processes.

Cryo-electron microscopy has recently started to allow the determination of near-atomic resolution structures of so-called supercomplexes of photosystems I and II, which can be even larger than 1 MDa. These structures lie at the basis of the light-harvesting reactions in photosynthesis. Together with the insights obtained from numerous spectroscopic studies these structures help to understand the primary processes in oxygenic photosynthesis [2] and this will be illustrated with several examples.

Now that we have so much structural and spectroscopic information about purified and isolated. (super-)complexes it is important to study the (ultra)fast light reactions *in vivo* to see the photosystems at work in their natural environment, where additional elements are present and regulation can be studied. For this *in vivo* research, spectroscopy methods can be combined with microscopy to obtain molecular, structural and functional information of those dynamic systems. Several examples will be given of recently studied regulatory processes of light harvesting *in vivo* and how they can differ at the molecular and cellular level in different organisms. Finally, new directions for future biophysical research for the study of photosynthesis will be discussed.

[1] R. Croce, H. van Amerongen, *Nature Chem. Biol.* **10**, 492-501 (2014).
[2] R. Croce, H. van Amerongen H *Science* 369: eaay2058 (2020)