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# Engineering photosynthetic light harvesting systems for enhanced light use efficiency and environmental sustainability

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**12.00 p.m.**

CIC biomaGUNE - Seminar Room

Photosynthetic organisms interface the sun energy flow with biosphere by catalyzing the reduction of CO2 with electrons from water. The efficiency of photosynthetic light energy conversion is critical for food, fuel and environmental sustainability. The photosynthetic machinery is localized in the chloroplast and includes chlorophyll-binding complexes catalyzing light-dependent reactions in membranes (thylakoids), to produce NADPH +H+ and ATP, and dark reactions, localized in the soluble, stromal, phase, which reduces CO2 to sugars. While the CO2 substrate is recycled by heterothrophs, the O2 product accumulated to 21% in the athmosphere and is a major inhibitor of both light and dark reactions, thus limiting light use efficiency to very low levels, below 0,5%, in outdoor conditions.

Light reactions are limited by photodamage through formation of chlorophyll high energy triplet states, which react with O2, forming ROS and disrupting pigment-protein complexes. Further, light spectrum, intensity and dynamics strongly depends on environmental conditions. Thus, balancing light harvesting and photoprotection is a key strategy for enhancing productivity of plants and algae. Both functions are catalyzed by a multigene-encoded pigment-protein family serving reaction centres. Identification of the function for each gene product and engineering their spectroscopic properties was made possible by combination of genome editing, ultrafast spectroscopy and cryo-electron microscopy which allow for iterative structure-function analysis and phenotypic evaluation. In this talk examples will be given for engeneering procedures tuning wavelength absorption and photoprotection properties of photosynthetic complexes towards a rational, structure-function based, enhancement of photosynthetic light use efficiency.