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## Introduction: light harvesting for photosynthesis

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The energy from the Sun that strikes the surface of the Earth *per hour* approximates the human energy consumption of 1 year and supports all life on our planet. Harvesting of sunlight is the first event in the solar-energy conversion process that is carried out by all photosynthetic organisms. Their light-harvesting antennas show large variation in structure and pigment compositions, which enables them to adapt to the light conditions in their natural habitat. Yet, the antennas share an architecture in which all excitations are efficiently transferred to a photosynthetic reaction center. Plants and photosynthetic algae also developed strategies to acclimate to varying light conditions during seasons and can rapidly adjust their antenna sizes in case of excess light, avoiding over-excitation and formation of harmful byproducts. To date, the combination of spectroscopic data with high-resolution structures of various antenna complexes has strongly improved our understanding of the process of excitation energy transfer and inspired design of solar materials (Mirkovic et al. 2017). However, the adaptive and regulatory mechanisms by which light-harvesting antenna systems respond to variations in light intensity and quality, redirect excitation-transfer pathways and dissipate excess excitation energy still have many unsolved questions. At this

point in time, we are faced with a rapidly changing climate, and there is an urgent need to gain in-depth understanding of these light-harvesting processes that eventually can be manipulated to optimize photosynthetic efficiency and ensure plant fitness in fluctuating environments (Croce and van Amerongen 2014; Blankenship et al. 2011; Scholes et al. 2011; Ort et al. 2015).

In this light, we present the special issue on photosynthetic light harvesting containing a selection of the work that was presented at the Light Harvesting Satellite Meeting, held in August 2016 in Egmond aan Zee, The Netherlands, in conjunction with the 17th International Congress on Photosynthesis Research (van Amerongen and Croce 2016). More than 100 researchers from all over the world working in the fields of biophysics, molecular and structural biology, biological, physical and theoretical chemistry of photosynthesis attended this satellite meeting and actively contributed through poster and oral presentations. In particular, many young researchers were given the opportunity to present their work in oral sessions. The meeting sessions, followed by separate discussion sessions, focused on the mechanisms of light-harvesting regulation from molecules to leaves and reported new insights on the dynamics and assembly of light-harvesting superstructures and on photo-physical models for excitation energy transfer and dissipation. Finally, emerging approaches were presented that will advance our understanding of these topics. We were also delighted to incorporate a special evening program that was dedicated to, and organized by, the so-called 49-ers: a generation of prominent scientists, all born in the year  $1949 \pm 1$ , who pioneered the research field of photosynthetic light harvesting, leading to the wealth of information on light-harvesting structures and processes that we have today. Four historical lectures were given by Richard Cogdell, Graham Fleming,

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Arvi Freiberg and Leonas Valkunas which can be viewed via <http://tiny.cc/LH2016Egmond49ers>.

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