Title: Artificial light-harvesting antenna based on an aggregation of bacteriochlorophyll c with selected pigments

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Abstract: Solar energy is one of the most important energy sources for all living organisms. The light harvesting takes place in specialised photosynthetic complexes called antennas; they typically contain pigments held by a protein scaffold. Antennas of green bacteria, chlorosomes, are unique in this respect, for they do not need proteins to organise the pigments. The pigments contained in chlorosomes, bacteriochlorophyll (BChl) *c*, *d* or *e*, aggregate spontaneously. This self-aggregation can be used to form an artificial light-harvesting antenna the absorption spectrum of which can be extended by addition of other pigments.

Antennas based on aggregation of BChl *c* with β-carotene and BChl *a* were prepared by a fast and slow method. The excitation energy transfer efficiency between these pigments was studied. The efficiency of energy transfer from BChl *c* to BChl *a* reached up to 95 %, the efficiency of energy transfer from β-carotene to BChl *c* was lower. An important role of β-carotene in artificial aggregates as well as in chlorosomes is its efficient quenching of BChl *c* triplet states, which could otherwise generate singlet oxygen harmful to the antenna. Atomic force microscopy was utilised to study the structure of individual aggregates. In some aggregates, a larger emission dipole strength compared to monomeric BChl *c* was observed, allowing for more efficient energy transfer.

Keywords: Artificial photosynthesis, light-harvesting, excitation energy transfer, superradiance, green photosynthetic bacteria