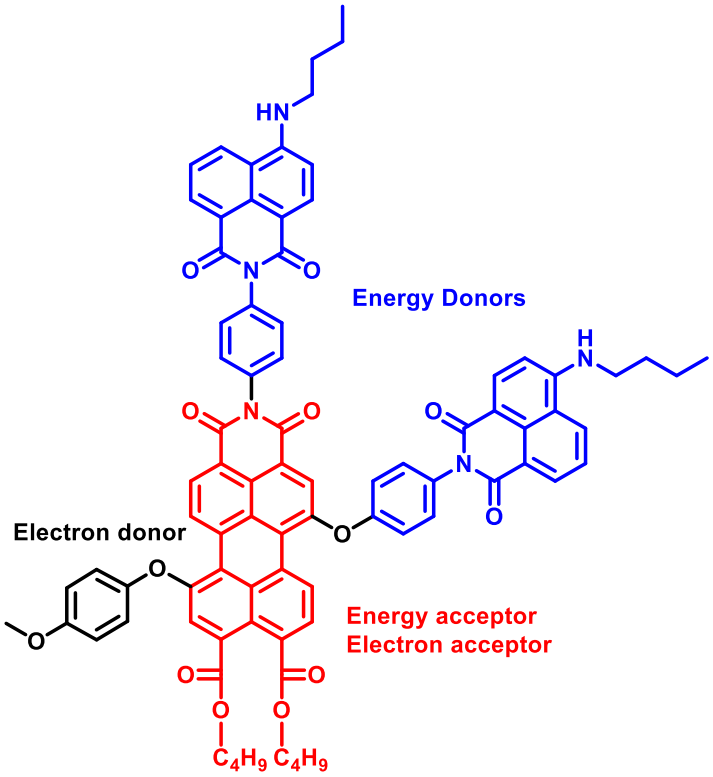
Improved Light-harvesting Antenna molecules for artificial synthesis



Artificial photosynthesis, the production of chemicals from sunlight and small readily-available molecules, is badly needed for securing the energy needs of future generations in a sustainable manner. The first step in photosynthesis is absorption of sunlight and for that purpose we have recently developed highly efficient light-harvesting antenna molecules.[1] Such molecules contain multiple chromophores that absorb complementary parts of the solar spectrum and funnel the excitation energy to the central chromophore.

Based on the design rules that we extracted from previous research,[2] we wish to take the next step and develop light-harvesting antenna molecules that contains an electron donor at the central chromophore.[3] Such molecules mimic the first two steps of artificial photosynthesis, light-harvesting *and* charge transfer, and bring us closer to the realisation of artificial photosynthesis.

In this proposal organic synthesis and photophysical characterisation of the antenna molecules are the major ingredients. Detecting the order of the photophysical events (excitation, energy transfer, charge transfer), measuring their rate constants and fine tuning the process by proper molecular design are the key ingredients of this research project.

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[1] *Tunable and Highly Efficient Light-Harvesting Antenna Systems Based on 1,7-Perylene-3,4,9,10-Tetracarboxylic Acid Derivatives*. Dubey, R. K.; Inan, D.; Sengupta, S.; Sudhölter, E. J. R.; Grozema, F. C.; Jager, W. F. *Chem Sci*. **2016**, *7*, 3517-3532.

[2] Substitution Effects on the Photoinduced Charge-Transfer Properties of Nover Perylene-3,4,9,10-tetracarboxylic Acid Derivatives. Inan, D.; Dubey, R. D.; Westerveld, N.; Bleeker, J.; Jager, W. F.; Grozema, F. C. *J. Phys Chem. A*, **2017**, *121*, 4633-4644.

[3] *Synthesis of Perylene-3,4,9,10-tetracarboxylic Acid Derivatives Bearing Four Different Substitutions at the Perylene Core*. Dubey, R. K.; Westerveld, N.; Eustace, S. J.; Grozema, F. C.; Sudhölter, E. J. R.; Wolter F. Jager. *Org. Lett.* **2016**, *18*, 5648-5651.