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Towards artificial photosynthesis on the lipid bilayer of liposomes

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Propositions (stellingen)

accompanying the thesis

Towards artificial photosynthesis at the water interface of liposome membranes

1. Artificial photosynthesis can only become a sustainable technology when the current catalysts and photosensitisers, which are based on noble metals, can be replaced by compounds made exclusively of earth-abundant elements. (Gust *et al.*, *Acc. Chem. Res.* **2009**, *42* (12), 1890-1898)
2. Instead of using sacrificial electron donors and acceptors to study half-reactions individually, we need to find suitable electron relays that can couple both half-reactions. (Pellegrin *et al.*, *C. R. Chim.* **2017**, *20*, 283-295. Wang *et al.*, *Nat. Chem.* **2021**, *13*, 358-366)
3. Liposomes provide a versatile platform for immobilising both polar as well as apolar compounds. (Robinson *et al.*, *Chem. Soc. Rev.* **1991**, *20*, 49-94. Hansen *et al.*, *Chem. Eur. J.* **2016**, *22*, 58-72. *This thesis, Chapter 1*)
4. The fluidity of the liposomal membrane of photocatalytic liposomes has clearly an effect on the rate of photocatalysis, but this dependence does not seem to follow any logic yet. (Hansen *et al.*, *Chem. Sci.* **2014**, *5*, 2683-2687. Troppmann *et al.*, *Chem. Eur. J.* **2014**, *20*, 14570-14574. Troppmann *et al.*, *Eur. J. Inorg. Chem.* **2016**, *2016*, 554-560. *This thesis, Chapter 4*)
5. Appropriate leakage assays are required to assess whether genuine photoinduced transmembrane electron transfer actually occurs. (*This thesis, Chapter 2*)
6. Molecular dynamics simulations are a powerful methodology for determining the orientation of membrane-embedded molecules with respect to the liposomal bilayer. (*This thesis, Chapter 2*)
7. When preparing dissymmetric lipid membranes it is crucial to control the osmolarity of both the inner and outer aqueous phases of the liposomes. (*This thesis, Chapters 2 and 5*)
8. It is important to know the exact number of catalyst and photosensitiser molecules immobilised on a liposomal surface to be able to quantify (photo)catalytic turnover numbers. (*This thesis, Chapter 3*)
9. Preparing liposomes is like cooking; you have a recipe, but the outcome of each new preparation might be slightly different from the previous one.
10. Better buy an apparently expensive chemical than ask a more expensive PhD student to try to (unsuccessfully) synthesise it.
11. Getting a child during your PhD makes you more productive at work.
12. Doing research is like playing a game of chess: you have to consider every opportunity that is given to you. Sometimes you win, sometimes you lose, but you always improve on the way.