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DEPARTMENT OF BIOLOGICAL AND ENVIRONMENTAL SCIENCES

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Review of the PhD-Thesis of Jakub Dostál

Lund University has invited me to act as an opponent in the PhD-Thesis defense of Jakub Dostal. In this letter I state my opinion about his thesis "Photosynthetic Apparatus of Green Sulphur Bacteria Studied by Coherent Two-Dimensional Electronic Spectroscopy".

The Thesis consists of the Introduction-part and four independent publications which all are closely related the title of the thesis. The Introduction-part contains two chapters in which one introduces very successfully the core idea of the two-dimensional electron spectroscopy (2DES) and also pinpoints the advantages and disadvantages of the 2DES in comparison with more generally known transient absorption techniques. In the other chapter, the samples of the thesis are introduced on a general level. This chapter is also well written and introduces very nicely the samples for the reader, although the candidate has left out a quite a bit detailed discussion about molecular arrangement of the chlorosomes, which would have given more clear view for the reader about the construction of the chlorosomes. After the introduction part the main results are successfully introduced.

The Thesis contains also five individual papers. Three out of the five papers are published in esteemed refereed journals, one paper is currently under review, and one paper is on the manuscript stage. According to the contribution description the candidate has had a major role in four out of these five papers. He has performed the experiments, done the data-analysis of the experimental results and has had a leading role in writing the papers. This indicates both strong hands on experimental skills and deep theoretical understanding on this demanding experimental technique by the candidate. It is also clear that the candidate is capable to handle biological material for his experiments.

Without going into details of the papers and introduction, which will be discussed in the public defense of the Doctoral Thesis, I can already now commend the Thesis. The 2DES is a new and approaching technique, which has clear benefits in measuring ultra-fast excitation energy processes in molecules. Still, it has its challenges, first being a rather demanding measurement technique, but more in explaining the observed data and putting the results in the theoretical framework. Both aspects has clearly been put forward during the PhD-project of the candidate. In the early 2DES experiments on photosynthetic systems, strong arguments for quantum coherence phenomena in photosynthetic complexes was put forwards. This Thesis clearly challenges this idea. It demonstrates that the oscillations, which were observed already in the earlier

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work with photosynthetic systems, originate rather due to vibrational coherence than electronic coherence. In the last chapter a very ambitious aim has been set where the overall energy transfer process from the complete photosystem has been measured in vivo and great experimental challenges has been overcome during the measurement procedure. This type of information is extremely valuable in order to understand the excitation energy transfer phenomenon in the photosynthetic systems, and to push the limits of the new technique to the next level.

Therefore, I strongly support for printing of the Thesis and I am looking forward the public defense of the Doctoral Thesis.



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