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Dr. Christian Matthäus

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## Review of „Raman microspectroscopy of living cells and biological tissue“ by Mgr. Šárka Moudříková

The submitted thesis addresses the application of Raman spectroscopy coupled with the optical settings of visible-light confocal microscopy to investigate microalgal species. Over the past decade the methodology has drawn increasing interest as a new way to investigate and characterize biological tissue in a label free manner without the need of laborious sample preparation. The non-invasive nature of the method also allows the monitoring of living organisms, such as individual cells or tissue compartments. Although the optical setup of the instrumentation is commercially available, the settings, such as employed objectives, fibers, gratings, detector etc. need to be worked out and optimized for the individual sample type under investigation. Mgr. Šárka Moudříková has obviously elaborated the optimal conditions for monitoring different cell categories in particular for microalgae. The bases for the presented results are thoroughly worked out workflow protocols for every respective application. Her work set the conditions for three already published contributions in very well respected, peer-reviewed scientific journals, with strong impact factors in the applied field of Microalgae Biology, as well as Analytical Chemistry. Specifically, Mgr. Šárka Moudříková investigated different microalgae and compared Raman microscopy with other imaging techniques, discovered crystalline aggregation of the nucleobase guanine in several algae and demonstrated the possibility to use Raman scattering intensities as a technique to quantify the amounts of different biologically relevant molecular species within single individual cells. Several observations reported in these publications are explicitly novel and cannot be obtained by other techniques. It is for instance not possible to concurrently record chemical information of various biomolecular species such as lipids, polysaccharides, proteins and chromophores, like carotenoids or chlorophyll, at the optical resolution of conventional microscopy. In this regard Mgr. Šárka Moudříková fulfills the aspect of scientific novelty very impressively.

The presented studies are very good examples of a successful interdisciplinary coordination, as they combine Chemical Analytics, essentially related to phenomena based on Physics applied to Cellular Biology. Interdisciplinary approaches are currently very well appreciated strategies to elucidate complex interrelations, especially in the life sciences. The results are therefore interesting for a very broad readership ranging from Physics to Biology and to some extent Health Sciences. With respect to monitoring different growth conditions for microalgae the presented work generates new experimental possibilities, which are very important for Environmental Biology in particular, because of the essential role of microorganisms for crucial planetary processes. Various further applications can be initiated by following the experimental approaches laid out in this thesis.

By coordinating this work Mgr. Šárka Moudříková has fully demonstrated her ability to work as an independent creative scientist. This includes all key aspects ranging from careful planning and conduction of relevant experiments in an efficient time frame, all the way to rational interpretation of the obtained results, scientific record keeping as well as scientific writing. I am impressed by the overall performance and would like to wish Mgr. Šárka Moudříková good luck with all future endeavors.

Sincerely,

Dr. Christian Matthäus