

# ***Vibrational micro(spectro)scopy at different scales: Proteins, membranes and living cells***

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Time-resolved FTIR difference spectroscopy can be used to monitor the reactions within membrane proteins at atomic detail with ns time-resolution (1). In order to investigate the protein interactions at membranes the ATR (attenuated total reflection) technique is applied (2). Thereby the protein interaction network of the membrane bound Ras superfamily is monitored spatio-temporal resolved at atomic detail. At the level of single cells and tissues vibrational microspectroscopy (Raman and IR) studies are performed which provide marker-free images of single cells and tissue. This approach is applied to colon cancer cell lines and to colon cancer tissue. After annotation of the index colour images by comparison with conventionally stained tissue by a pathologist and by fluorescence markers label-free spectral biomarkers are identified. Based on these spectral biomarkers a random forest analysis provides an automated detailed assignment of the colon tissue and identified the cancer. This approach is recently extended to bladder cancer. Here in addition to tissue also urine and blood plasma is analysed to identify spectral biomarkers in liquids.

## References

- [1] F. Garczarek, K. Gerwert, *Nature* 439, 109-112 (2006).
- [2] J. Güldenhaupt, Y. Adigüzel, J. Kuhlmann, H. Waldmann, C. Kötting and K. Gerwert, *FEBS Journal* 275, 5910-5918 (2008).