Clinical Biophotonics: From Bench to Bedside

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The use of optical photonic approaches outside specialized optical laboratories directly at the end user requires easy to use optical / photonic instruments with a high TRL level. Here, the application of optical methods to address biomedical research has grown rapidly over the past ten years and has advanced into a new era due to advances in instrumentation and most importantly due to an enhanced cross-disciplinary dialogue between spectroscopists and clinicians. In this contribution we report on various innovative technological concepts for bringing optical approaches with special focus on linear and non-linear Raman spectroscopy closer to the end-user like e.g. clinical use. We will among other report about the realization of a compact and portable CARS/SHG/TPEF approach, which can be applied both microscopically or endoscopically to reliably assess tumor tissue and the success of an operation directly in the operating theatre. Furthermore, we report on a high-throughput automated Raman spectroscopy platform for the analysis of cells. With this high-throughput platform Raman spectra of tens of thousands of cells can be rapidly measured via a complete automation of the complete process chain. At the end we introduce an automated Raman platform in combination with specially developed chips (e.g. dielectrophoresis chip) for microbial analysis. The application of this automated approach in a clinical environment for a rapid identification of sepsis pathogens together with an antibiotic susceptibility testing will be presented.

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Juergen Popp holds since 2002 a chair for Physical Chemistry at the Friedrich-Schiller University Jena, Germany. Since 2006 he is also the scientific director of the Leibniz Institute of Photonic Technology, Jena. Juergen Popp is a world leading expert in Biophotonic / optical health technology research covering the complete range from photonic basic research towards translation into clinically applicable methods. He has published more than 900 journal papers, has been named as an inventor on 12 patents and has given more than 200 invited talks on national and international conferences (among them more than 50 keynote/plenary lectures). In addition, he organized numerous conferences and workshops (e.g. the world largest conference on Raman spectroscopy ICORS in 2014). He is Editor-in-Chief of the Journal of Biophotonics. Furthermore, he is a leading partner in various national and international projects in cooperation with academic, clinical and industrial partners and has raised more than 50 Million-euro third party funding. He has been frequently asked as a contact person for media and politics. In 2012, he received an honorary doctoral degree from Babeş-Bolyai University in Cluj-Napoca, Romania. Professor Jürgen Popp is the recipient of the 2013 Robert Kellner Lecture Award and the prestigious 2016 Pittsburgh Spectroscopy Award. In 2016 he was elected to the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows. 2018 Juergen Popp was awarded the renowned Ioannes Marcus Marci Medal of the Czechoslovak Spectroscopy Society, he won the third prize of the Berthold Leibinger Innovationspreis and received the *Kaiser-Friedrich-Forschungspreis*. In 2019 he was awarded the *Ralf-Dahrendorf-Preis für den Europäischen Forschungsraum.* In 2020 he became an OSA senior fellow and in 2021 Fellow of the *Royal Society of Chemistry*.