

Oral presentation

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## Fluorescence spectroscopy and fluorescence imaging for tissue diagnostics – principles and methods

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In an attempt to establish intraoperative tissue diagnosis, tools and methods for an "optical biopsy" have been proposed, some of them exploiting fluorescent properties of endogenous or exogenous fluorochromes.

Fluorescence spectroscopy tries to capture characteristic spectral features of fluorochromes and correlate these with the disease state. Several mathematical methods have been proposed to evaluate recorded spectra to maximize the discrimination between "normal" and "malignant". However, they ignore the influence of tissue parameters on the recorded spectra. Some of these parameters may provide some correlation with the disease progress (epithelial thickness, loosening of collagen matrix), others may cause false positives; because "truly malignant" and "harmless change" have the same influence on the spectral signatures (e.g. blood absorption). Therefore, it may be desirable to eliminate the influence of some of these parameters, which has an influence on the design of the probes used to record the spectra. "Differential pathway spectroscopy", "intrinsic fluorescence" or "single fibre fluorescence" try to solve these problems.

Fluorescence imaging aims at highlighting malignant tissue, especially where it is not evident under white light in a large field of view. Autofluorescence as well as drug-induced fluorescence can be detected and displayed with commercial equipment. They usually rely on capturing fluorescence in one or two colour channels and remission

in another channel. Sophisticated image processing to quantify fluorescence or eliminate disturbing signal is only slowly becoming available.

In order to fulfil the requirements for an "optical biopsy", fluorescence techniques will have to be combined with OCT, acousto-optics and con-focal or two-photon techniques.