



MARTIN WOLF, 'Near-infrared spectroscopy: State of the art and potential'

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Seminar, February 1st, 12.00h, Conference Room, 3rd floor, Nexus II

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Near-infrared spectroscopy (NIRS) has become a quickly growing method to noninvasively study human tissue using near infrared light, which penetrates tissue several cm deep. The method is appreciated by patients and researchers, because it is quantitative, measures continuously, is painless, can be used at the bedside and is relatively inexpensive. Based on established physical models light absorption and scattering of tissue can be measured, which in turn yields important physiological parameters (e.g. oxygenation) and allows to monitor the function of biological tissue. Using multiple wavelengths the concentration of constituents of tissue such as oxyhemoglobin, deoxyhemoglobin, water, lipids and cytochrome oxydase can be quantified. Multiple light source and detector combinations produce images of whole tissue areas. Results of simulations and new developments in sensor design will be shown. Since NIRS has a high time resolution (ms) changes due to physiological processes or interventions can be monitored.

Applications of NIRS are presented to illuminate its promising properties:

1. Functional investigations of the brain. A recent exciting discovery is the fast neuronal signal, which is related to optical changes directly associated with neuronal activity in the brain. NIRS has the unique capability to measure both the hemodynamic and the neuronal reaction of the brain to functional stimulation. Images and videos of such measurements in adults and newborns are shown.

2. Test of hemodynamics in the muscle. Using a venous occlusion we measured blood flow, oxygen consumption, venous oxygen saturation and hemoglobin accumulation in the calf muscle of healthy subjects and patients with peripheral arterial occlusive disease.

3. Novel quantitative multi-frequency NIRS. Changes in tissue composition in the female breast during the menstrual cycle were measured.

These applications demonstrate the excellent potential of NIRS in biomedical engineering and medicine. The seminar will be concluded by a vision of future applications and research.