OXYMON *Mk III*

Optical Imaging made easy and affordable

Introduction

All cells in all organs of the body have a constant but variable need for oxygen. However the body stores for oxygen are minimal. So a constant and adequate supply of oxygen to the tissues through the circulation is essential. In critical situations therefore monitoring a subject's local tissue oxygenation can be of live-saving value. This information can be obtained with the Oxymon which utilizes the technique of near infrared spectroscopy.

Applications

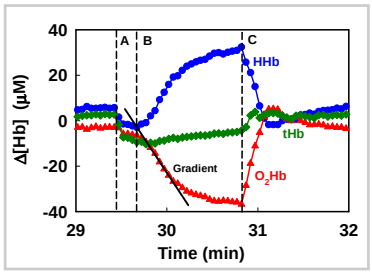
Main applications are found while monitoring brain and/ or muscle tissue:

- Researching patients in the operating theatre or in intensive care units where the oxygen supply to the brain might become critical.
- Neonatal research.
- Researching a hampered blood supply to the limbs, e.g. as seen in peripheral vascular disease.
- Monitoring of regional muscle oxygenation in sports medicine or during rehabilitation training.
- Measuring regional flow, volume and saturation.
- Functional brain monitoring, e.g. measuring the response of brain oxygenation to a sensory stimulus.
- Fast optical signal.

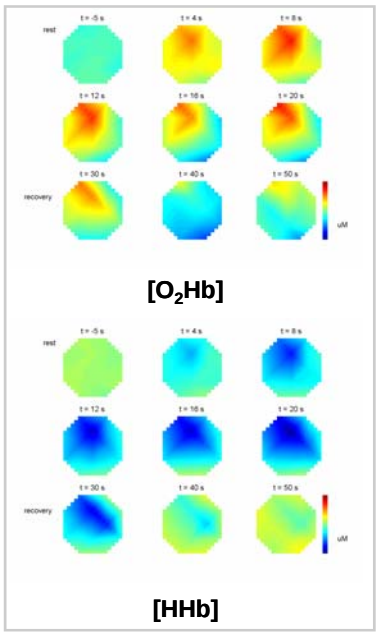
Principle

Near infrared spectroscopy (NIRS), the technique on which the Oxymon is based, relies mainly on two characteristics of human tissue. Firstly, the relative transparency of tissue for light in the NIR range, and secondly to the oxygenation dependent absorbance of hemoglobin. Using the Oxymon, being based on this principle, it becomes possible to monitor your subject:

- Non-invasively.
- Easily transportable, bedside measurements.
- With continuous recording and feedback.
- Without the need of a special infrastructure.
- Without specially trained personnel.
- Affordable and no disposables needed.



Example of measurement on muscle, where an exercise period (A) is followed by an occlusion (B-C) from which the local oxygen consumption (mVO_2) is determined from the gradient of the oxyhemoglobin (O_2Hb) signal.



Example of a functional NIRS tracing using a 12 channel setup. The optodes are placed over the left motor cortex, while the subject performs a finger tapping task with his left hand during 20 seconds, starting at t = 0 s. An increase in blood flow is observed over the motor cortex.

Company Information

ARTINIS MEDICAL SYSTEMS B.V.
St. Walburg 4
6671 AS Zetten
The Netherlands

Tel: +31 488 422 710
Fax: +31 488 422 829

E-mail: oxymon@artinis.com
Web: www.artinis.com

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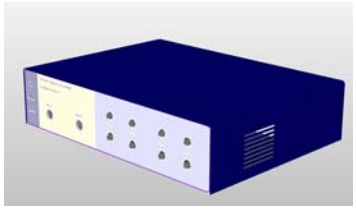
Oxymon

The Oxymon is a scientifically sound and user friendly instrument. The Oxymon is designed as a plug-and-play instrument. This means that you can start with one or two channels, and gradually extent the number of channels according to your needs. Multiple cabinets can be interconnected for multi-channel measurements, but can also be used separately. Data collected with the Oxymon are stored on a separate PC, easily accessible for analysis, backup and export. Important are the options for customized hardware and software, like NMR

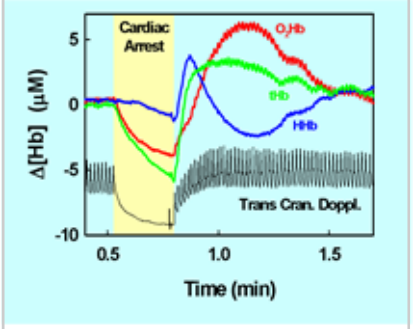


Multi Channel Oxymon Mk III system

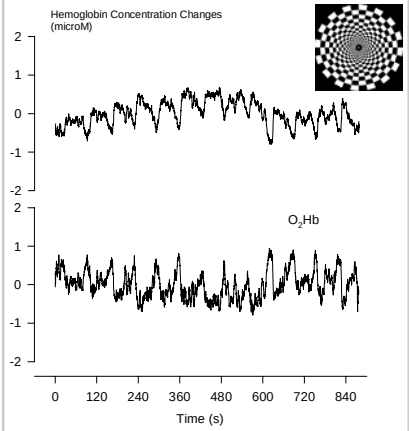
Oxysoft

Without good tools for data analysis, data collection is a useless time expenditure. Therefore we developed the dedicated OXYSOFT data analysis software with features like:

- > Easy to manage measurement files all within one project
- > Filtering, viewing and expanding of data
- > Viewing and expanding of data.
- > Calculating average, mean and standard deviation.
- > Calculating differences between selected time frames.
- > Calculation of O_2 consumption, blood flow and more.
- > Calculating averages of stimuli (e.g. for *f*NIR studies)
- > Export data to Excel
- > Perform spectral analysis



Simultaneous NIRS and trans cranial Doppler registration of a patient during an elective cardiac arrest. Optodes were placed on the frontal side of the head, with a distance of 5.5 cm.



This is the an unfiltered tracing of the oxygenation changes in the left visual cortex of one subject, while watching 13 blocks of a flickering checkerboard on a computer screen (see inlet in right upper corner). Each block lasts 20 seconds.

Technical details

Technology	Continuous wave near infrared spectroscopy
Measures	Changes in oxy- and deoxyhemoglobin and regional tissue saturation (optional)
PC	Communicates with any PC/laptop via USB
Channels	Between 1 and 48, depending on configuration
Light source	Pulsed light sources
Wavelengths	Standard 780 and 855 nm, others possible
Detector(s)	Avalanche photo diode, ambient light protection
Sampling time	50 Hz to 10 seconds (up to 250 Hz optional)
External inputs	Optional are 8 additional analog data inputs at 50 Hz (up to 250 Hz optional)
Optodes	Standard 3 meter long, other lengths available
Power	Auto sensing 110-240V, approx. 40 Watt
Environment	Operating temp. ~10-27 ºC, both source and detector temperature stabilized, altitude 0-5750 m

References

>> Mehagnoul-Schipper DJ, van der Kallen B, Colier WNJM et. al. Simultaneous measurements of cerebral oxygenation changes during brain activation by NIRS and fMRI in healthy young and elderly subjects. *Human Brain Mapping* 2002. 16: 14-23.

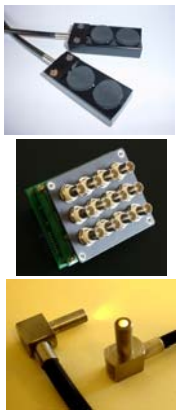
>> Colier WNJM, Quaresima V, Wenzel R, van der Sluijs MC, Oeseburg B, Ferrari M, Villringer A. Hemodynamic changes detected simultaneously in both occipital areas by functional near infrared spectroscopy. *Vision Res.* 2001; 41:97-102.

>> Colier WNJM, Binkhorst RA, Hopman MT and Oeseburg B. Cerebral and circulatory haemodynamics before vasovagal syncope induced by orthostatic stress. *Clin Physiol.* 1997; 17(1): 83-94.

>> van Beekvelt MC, Colier WNJM, Wevers RA, van Engelen B. Performance of near-infrared spectroscopy in measuring local oxygen consumption and blood flow in skeletal muscle. *J Appl Physiol* 2001. 90: 511-519.

>> van Beekvelt MC, van Engelen BG, Wevers RA, Colier WNJM. Quantitative near-infrared spectroscopy discriminates between mitochondrial myopathies and normal muscle. *Ann Neurol*. 1999;46:667-70.

>> Quaresima V, Colier WNJM, van der Sluijs M, Ferrari M. Nonuniform quadriceps O2 consumption revealed by multipoint measurements. *Biochem Biophys Res Comm* 2001; 285(4): 1034-39.



Being a small flexible company with a 14 year long experience in near infrared spectroscopy we are aware of the special needs of scientists. Custom made additions to the Oxymon, or support with setting up your research can all be arranged.