UNISENSE©

SOLUTIONS FOR MICROSCALE MEASUREMENTS

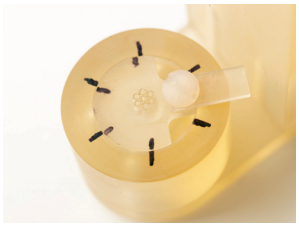
ENABLING

SCIENTIFIC

RESEARCH

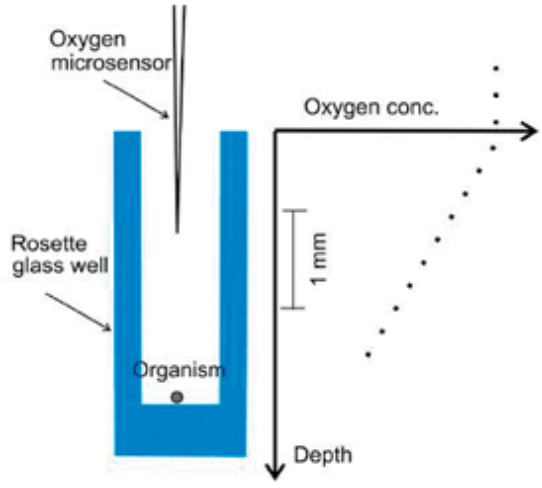
Unisense Nanorespiration system

- most sensitive respirometer worldwide



SYSTEM FEATURES

- Novel proprietary steady-state measurement principle (patent pending)
- Constant oxygen concentration facilitates prolonged and repeated measurements without stress
- Very low detection limits for oxygen consumption (sensitivity below 0.06 nL/hr = 0.7 fmol/s (f=10-15))
- High accuracy and reproducibility (± 0.03 nL/hr)
- Fast determination of the respiration rate (2 min)
- A broad range of respiration rates can be measured (0.1 to 5 nL/hr)
- Insignificant oxygen consumption by the sensor
- Organisms placed in oxygen impermeable and chemically inert glass capillaries
- Easy sterilisation by autoclaving
- Spreadsheet available for automated calculation of respiration rates
- Composed of chemically inert biocompatible material
- Small sensor diameter which does not disrupt the oxygen flux to the respiring organism.



Schematic drawing of Rosette capillary with organism and the measured oxygen concentration profile.

THE NANORESPIROMETER PRINCIPLE

The central unit in the Nano-respirometer system is the rosette of seven fused glass capillaries with a sealed glass bottom. Each capillary is filled with a suitable liquid medium and the respiring organism is placed on the glass bottom. As the organism consumes oxygen by respiration, a linear, steady-state oxygen gradient is established in the capillary. Due to the small dimensions, this is usually obtained within one hour. By measuring the oxygen concentration gradient and knowing the capillary dimensions, the oxygen flux towards the respiring organism can be calculated. This steady-state flux will be equal to the respiration rate of the organism in the capillary.

The oxygen concentration is measured with a Unisense oxygen microsensor. The oxygen consumption of this sensor is so small that it does not affect the oxygen gradient in the well.

The respiration rates are calculated by exporting the measured oxygen gradient data into a Unisense Flow Analysis spreadsheet which is freely available on our website.

MEASUREMENT OF THE OXYGEN GRADIENT

With a particularly narrow construction, the Unisense OX-NR is specifically designed for the nano-respiration system chambers. As for all other Unisense oxygen microsensors, the oxygen consumption of the sensor is insignificant due to its small dimensions and it will not disturb the oxygen gradient in the well.

Elements of the Nanorespirometer Unit

- *A rosette of 7 fused glass capillaries (length 3 mm, diameter 0.68 mm) (the rosette)*
- *A rosette disc made of UDEL polysulfone*
- *A rosette disc holder made of UDEL polysulfone*
- *A stable metal frameand the measured oxygen concentration profile.*

The Nano-respirometer Unit is mounted with the sensor on a Unisense automatic oxygen micro-profiling system. The signals from the sensor are amplified with the a high quality picoammeter (PA2000 or OXY-Meter) and recorded on a PC with the SensorTrace PRO software via the A/D converter (integrated in OXY-Meter or ADC216). The program controls the motorized micromanipulator via a motor controller and allows for recording, calibration, plotting, and storing of multiple automatically or manually measured micro-profiles of oxygen concentration measurements in the rosette.

The sensor position needs only be adjusted in one of the outer rosette capillaries. The “revolver-principle” then ensures that all other capillaries in the outer rosette ring are brought into position for profiling when the rosette disc is rotated

The concentration gradient data acquired with SensorTrace PRO is imported into the Unisense Profile Analysis spreadsheet, which calculates the respiration rates in each capillary. The spreadsheet is available for free from our website.

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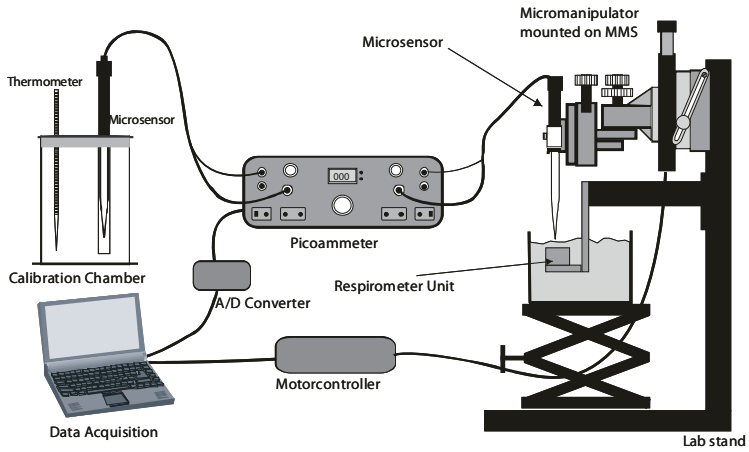

APPLICATIONS

Toxicity studies

High-resolution on-line measurements enable researchers to follow the development in respiration rate during the incubation period. This allows the researcher to evaluate the metabolic effect of adding toxic substances to the assay organism. The monitoring can be performed with a very high temporal resolution.

REFERENCES

Nielsen, P., Larsen, L.H., Ramløv, H., and Hansen, B.W. 2006. Respiration rates of subitaneous eggs from a marine calanoid copepod: monitored by nanorespirometry. Journal of Comparative Physiology B: Biochemical, Systemic, and Environmental Physiology. 28 Nov.2006 Online