



## Oxygraph-2k

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# Advances in High-Resolution Respirometry: OROBOROS Oxygraph-2k

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high-resolution respirometry  
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The OROBOROS Oxygraph-2k, with the Titration-Injection microPump (TIP2k) on top, and the Integrated Suction System (ISS) on the right.

The **OROBOROS Oxygraph-2k** with DatLab 4 software is the sole-source instrument for high-resolution respirometry, with the option of modular MultiSensor extension and electronically controlled Titration-Injection microPump (TIP2k), and accessories including the Integrated Suction System (ISS) and titration syringes. Please, visit [www.oroboros.at](http://www.oroboros.at) for newest information.

The OROBOROS® O2k-MultiSensor extension is the basis for application of our new Ion Selective Electrode (ISE) system for measurement of pH, mitochondrial membrane potential (TPP<sup>+</sup> electrode), and additional electrochemical sensors (NO). Our innovations are at the interface between instrumental development, research in bioenergetics and biomedicine, and world-wide distribution. Whereas the high-resolution analysis of oxygen concentration and flux remains the fundamental basis, the O2k-MultiSensor system integrates specific requirements in mitochondrial physiology with ion-selective electrodes and optical measurements.

Our instruments are represented in leading laboratories for basic and clinical research in 34 countries. You may contact our OROBOROS MiPNet Reference Laboratories in your geographical area: <http://www.oroboros.at/index.php?mipnet-labs>.

The OROBOROS Oxygraph-2k has become the standard where high resolution counts, at low respiratory activities, in particular for the analysis of cell cultures, muscle biopsies, including human applications, and for measurements at critical low oxygen levels. Combination with the Titration-Injection microPump (TIP2k) allows operation with programmable titration

regimes and at quasi steady-states, yielding a new flexibility in experimental design by combining the technical advantages of closed and open systems approaches. These developments lead not merely a system of high quality instruments but distinguish high-resolution respirometry as a method and concept.

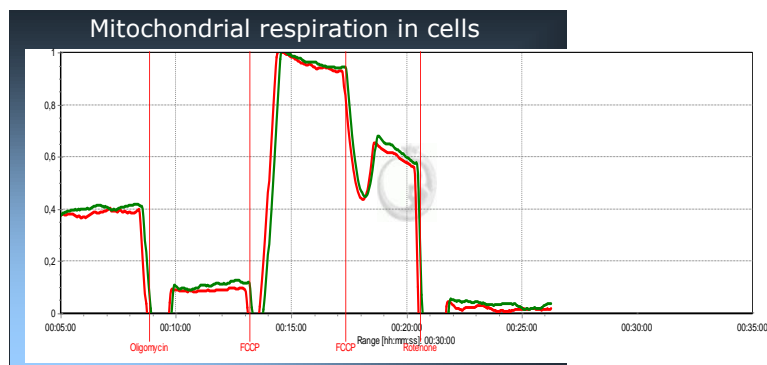
On the basis of recent developments and experimental tests, the OROBOROS team is excited to report about significant improvements of high-resolution respirometry with the Oxygraph-2k: Advances in electronics, smoother stirring at higher rates, higher precision of the glass chambers, and higher temperature stability of the Peltier system made possible a significant improvement of signal stability (2008-GnaigerE), beyond the high performance reported previously (2008-GnaigerE). Combined with the software upgrade DatLab 4, this opens up new perspectives for measurements with small samples of muscle fibers, human cells and microbiopsies.



### OROBOROS® Oxygraph-2k:

2-chamber titration-injection respirometer:

- 2 glass chambers with titanium or PVDF stoppers, PVDF stirrer bars.
- Electronic Peltier thermostat and 2 magnetic stirrers.
- **OROBOROS® DatLab 4** (Windows™) for MultiSensor data acquisition, control and on-line analysis.
- Continuous record of barometric pressure and block temperature.
- 2 identical polarographic oxygen sensors (for chamber A and B) with service kit.
- Modular extension to the O2k-MultiSensor System.
- For further details and specifications, see: <http://www.orooboros.at/index.php?oxygraph>
- Sole source information: <http://www.orooboros.at/index.php?oxygraph2k-chamber>



### OROBOROS® O2k-MultiSensor System


- New modular design based on the Oxygraph-2k, accommodating multiple sensors.
- DatLab update for MultiSensor data acquisition.
- The flexibility of design enables optical measurements to be made on-line during respirometric experiments. Insertion of various ion selective and reference electrodes is possible through modified stoppers.
- For further details and specifications, see: <http://www.orooboros.at/index.php?mipnetanalyzer>

### **OROBOROS Titration-Injection microPump-TIP2k**

- With step motor and TIP microprocessor control unit.
- New options for inhibitor titrations and kinetic studies.
- For steady-state injection respirometry ( $0.005 - 50 \mu\text{l}\cdot\text{s}^{-1}$ ) and automatic titration regimes ( $0.01 - 250 \mu\text{l}$ ).
- Convenient mounting and exchange of Hamilton syringes.
- TIP control and automatic event settings integrated into DatLab 4.
- Feedback control for oxystat or pH-stat titration regimes.
- Programmable complex titration regimes with variable volumes, number of steps and injection velocities.
- Special length injection microneedle with gas bubble-free connection.
- For further details and specifications, see:  
<http://www.orooboros.at/index.php?tip2k>



### **Introductory O2k- and MultiSensor-Workshop**

-  Oxygraph-2k workshops on High-Resolution Respirometry are organized several times per year:  
<http://www.orooboros.at/index.php?nextcourse>

### **References**

- Gnaiger E (2008) Polarographic oxygen sensors, the oxygraph and high-resolution respirometry to assess mitochondrial function. In: *Mitochondrial Dysfunction in Drug-Induced Toxicity* (Dykens JA, Will Y, eds) John Wiley: 327-352.
- Gnaiger E (2001) Bioenergetics at low oxygen: dependence of respiration and phosphorylation on oxygen and adenosine diphosphate supply. *Respir. Physiol.* 128: 277-297.