



Oxygraph-2k

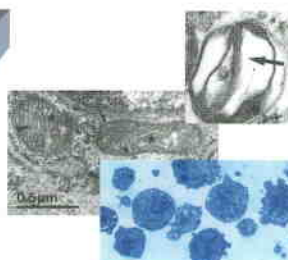
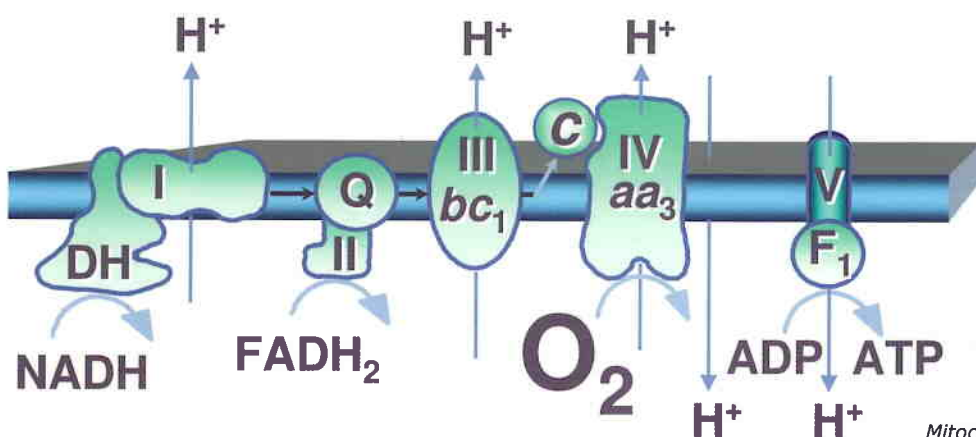
OROBOROS Oxygraph-2k & MultiSensor O2k-MiPNetAnalyzer

www.orooboros.at

Oxygraph-2k
DatLab 4
TiP-2k
ISS

Unique in high-resolution respirometry

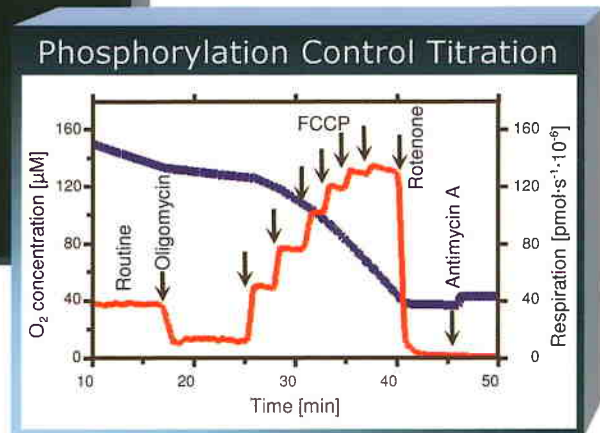
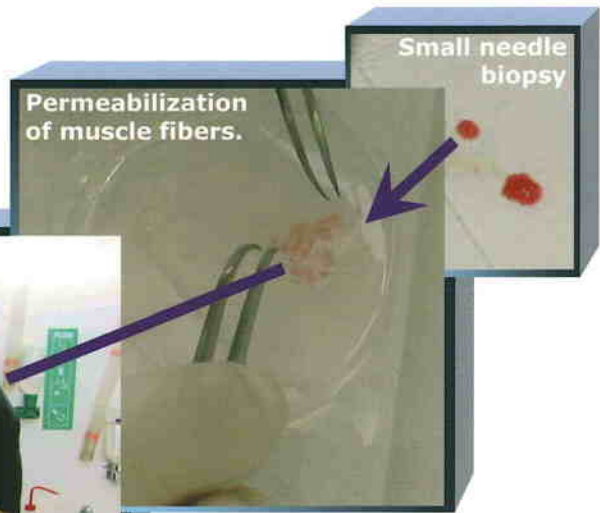
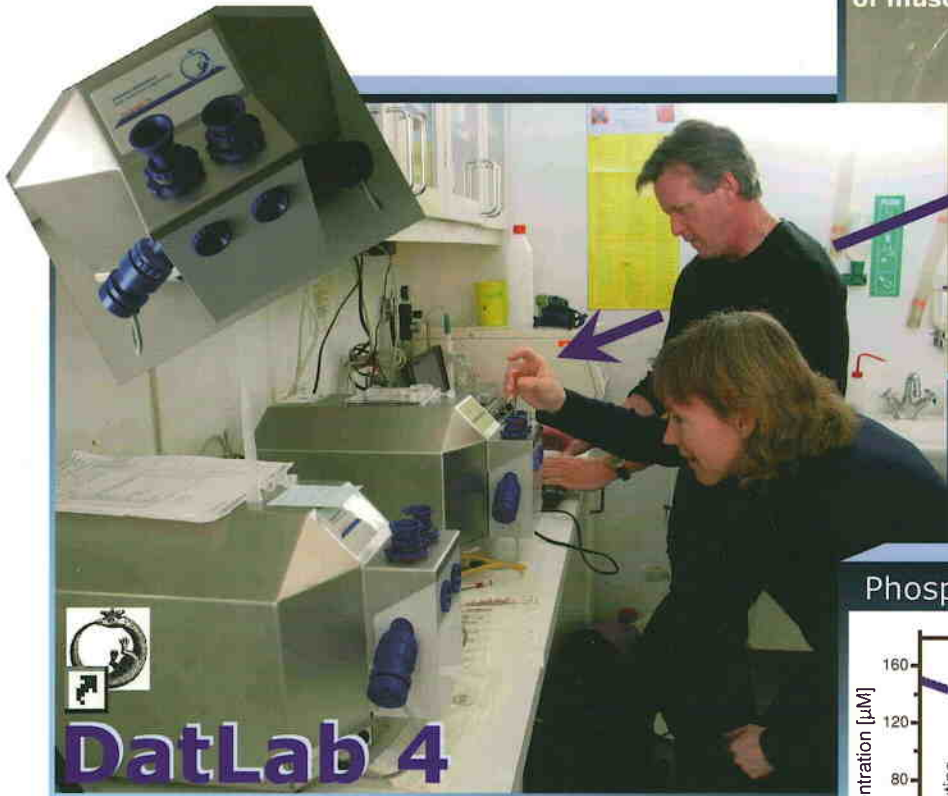
- for evaluation and diagnosis of mitochondrial function in health and disease
- mitochondrial physiology and pathology
- respiration of mitochondria, cultured cells and tissue biopsies
- bioenergetics.



© 2006 OROBOROS®

World-wide standard for diagnosis of mitochondrial function in health and disease

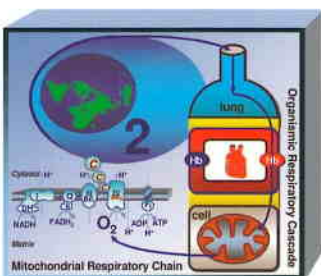
2 mg muscle biopsy wet weight per chamber.
Two simultaneous measurements in one O2k.
Multi-substrate/inhibitor titration protocols.



DatLab 4 – the scientific software for O2k high-resolution respirometry

State-of-the-art

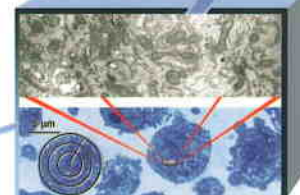
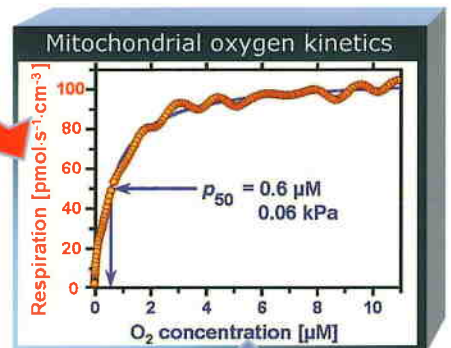
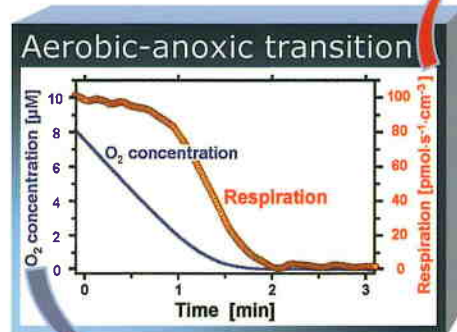
On-line display of oxygen concentration (blue; calibrated signal of the polarographic oxygen sensor, O2S) and cellular respiration (red; negative time derivative of oxygen concentration, displayed per million cells).

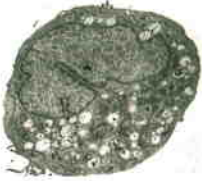


Oxygen kinetics

High-resolution respirometry is applied routinely to oxygen kinetics of cytochrome c oxidase, isolated mitochondria and cells. Results depend critically on

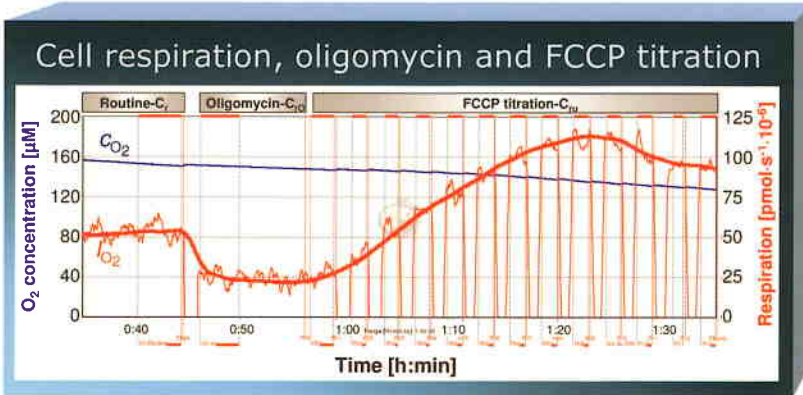
- (1) high time resolution,
- (2) background correction, and
- (3) internal correction for zero signal drift.
- (4) Over the oxygen range selected for non-linear fitting, a hyperbolic function is calculated to obtain the oxygen pressure at half-maximum flux, p_{50} .



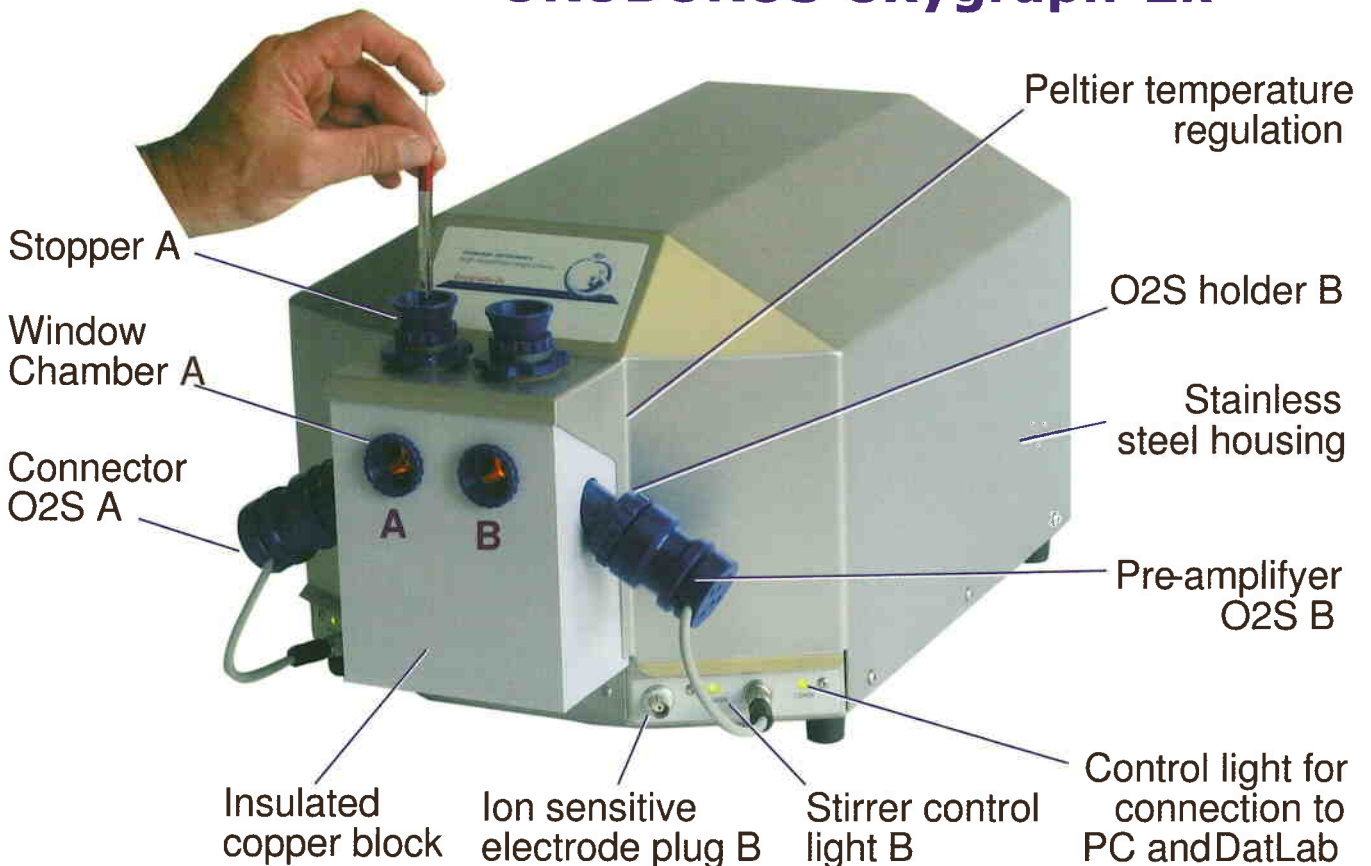


World-wide standard for respirometry with small amounts of cultured cells, at high dilution

0.3 million fibroblasts per chamber; automatic FCCP titration with the Titration-Injection microPump TIP-2k; on-line analysis by DatLab 4.



OROBOROS Oxygraph-2k



Selected references

Gnaiger E (2001) Bioenergetics at low oxygen: dependence of respiration and phosphorylation on oxygen and adenosine diphosphate supply. *Respir. Physiol.* 128: 277-291.

Gnaiger E (2003) Oxygen conformance of cellular respiration. A perspective of mitochondrial physiology. *Adv. Exp. Med. Biol.* 543: 39-56.

Gnaiger E, Méndez G, Hand SC (2000) High phosphorylation efficiency and depression of uncoupled respiration in mitochondria under hypoxia. *Proc. Natl. Acad. Sci. USA* 97: 11080-11085.

Gnaiger E, Steinlechner-Maran R, Méndez G, Eberl T, Margreiter R (1995) Control of mitochondrial and cellular respiration by oxygen. *J. Bioenerg. Biomembr.* 27: 583-596.

Hütter E, Renner K, Pfister G, Stöckl P, Jansen-Dürr P, Gnaiger E (2004) Senescence-associated changes in respiration and oxidative phosphorylation in primary human fibroblasts. *Biochem. J.* 380: 919-928.

Kuznetsov AV, Schneeberger S, Seiler R, Brandacher G, Mark W, Steurer W, Saks V, Usson Y, Margreiter R, Gnaiger E (2004) Mitochondrial defects and heterogeneous cytochrome c release after cardiac cold ischemia and reperfusion. *Am. J. Physiol. Heart Circ. Physiol.* 286: H1633-H1641.

For further references and updates see www.oroBOROS.at



OROBOROS Oxygraph-2k high-resolution respirometry

Integrated 2-chamber system
for respirometric studies
of mitochondria, cells, tissue
preparations, microorganisms.

- Two glass chambers: Paradigm shift to optimum volume (1.5 to 3 ml) instead of micro-chambers.
- Two polarographic oxygen sensors, special membrane application kit, high long-term stability, low zero current, ultra-low noise.
- Titanium stoppers and titanium injection capillaries, or PVDF, diffusion-tight sealings.
- PEEK or PVDF stirrer bars (teflon is inappropriate).
- Two electromagnetic stirrers (300 to 900 rpm).
- Integrated electronic Peltier temperature regulation: long-term stability better than ± 0.01 °C; 2 to 45 °C.
- Internal computing power (SPS technology).
- Stainless-steel housing, shielding the electronics.
- DatLab 4 - the scientific software for high-resolution respirometry - for Windows™.
- On-line display of oxygen flux and concentration.
- Low backdiffusion of oxygen; automatic background correction of oxygen flux.
- Continuous record of barometric pressure and temperature for automatic oxygen calibration.
- Integrated Suction System - ISS, for syphoning off medium from the O2k chamber.
- Electronic Titration-Injection microPump TIP-2k.

Beyond oxygen -

- Upgrading to the MultiSensor O2k-MiPNetAnalyzer.

Specifications

Oxygen Signal

Noise at zero oxygen:	<0.002 kPa (SD, 100 data points recorded at 2 s intervals) without smoothing; ± 0.003 kPa typical.
Noise at air saturation:	<0.010 kPa (SD, 100 data points recorded at 2 s intervals) without smoothing, at partial oxygen pressure of 20 kPa. ± 0.005 kPa typical; noise declines at low oxygen levels.
Digital resolution:	<0.001 kPa, with 100 % calibration at 20 kPa.
Time constant:	<7 s at ≥ 25 °C; 3-4 s typical.
O ₂ Range of linearity:	Oxygen partial pressure of 0 to 100 kPa.

Oxygen Flux (Respiration)

Limit of detection:	0.5 pmol·s ⁻¹ ·cm ⁻³ at steady-state over 5 min.
Sensitivity:	<2 pmol·s ⁻¹ ·cm ⁻³ at steady-state over 5 min at 20 - 40 °C.
Noise:	<0.2 pmol·s ⁻¹ ·cm ⁻³ after standard smoothing.
O ₂ range of measurement:	Flux measured at oxygen partial pressure up to 100 kPa and to <0.01 kPa based on DatLab analysis of oxygen kinetics in mitochondria and cells.

Instrumental background for correction over the entire experimental oxygen range

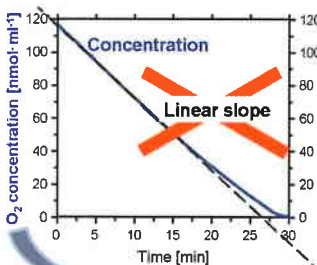
O ₂ backdiffusion at 0 kPa:	<3 pmol·s ⁻¹ ·cm ⁻³ at 20 to 40 °C. 2 pmol·s ⁻¹ ·cm ⁻³ typical.
O ₂ consumption at 20 kPa:	<4 pmol·s ⁻¹ ·cm ⁻³ at 37 °C; 3 pmol·s ⁻¹ ·cm ⁻³ typical. <3 pmol·s ⁻¹ ·cm ⁻³ at 25 °C; 1-2 pmol·s ⁻¹ ·cm ⁻³ typical.

Dimensions

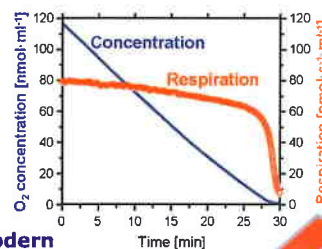
Main Unit: L 45 cm, W 31 cm, H 25 cm.

Packing

Box 1: Main unit; 22 kg; 54x40x36 cm.
Box 2: Accessories and TIP-2k;
13 kg; 61x34x27 cm.



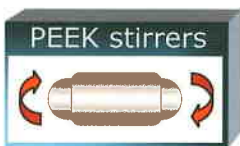
In the past:
oxygraphic
linear slopes
- traces appear
more linear than they are.



Modern
high-resolution
respirometry:
on-line display
of respiration.



Oxygraph-2k



Titration-Injection microPump TIP-2k

O2k

Integrated Suction System ISS



O2k Accessory Box

OROBOROS INSTRUMENTS
high-resolution respirometry

Oxygraph-2k



Contact

OROBOROS INSTRUMENTS GmbH
high-resolution respirometry
Schöpfstrasse 18
A-6020 Innsbruck, Austria
T/F +43 512 566796
instruments@oroboros.at

www.oroboros.at

Mitochondrial Physiology Network

Cooperation

Erich Gnaiger, A.Univ.-Prof. Ph.D.
Innsbruck Medical University
Dept. Transplant Surgery
D. Swarovski Research Laboratory
Innrain 66/6
T +43 512 504 24623, 24626
erich.gnaiger@uibk.ac.at

Cooperation and Feedback in Science

Visit us for information on
high-resolution respirometry,
new literature, protocols,
reference laboratories,
international courses, news, ...



www.oroboros.at