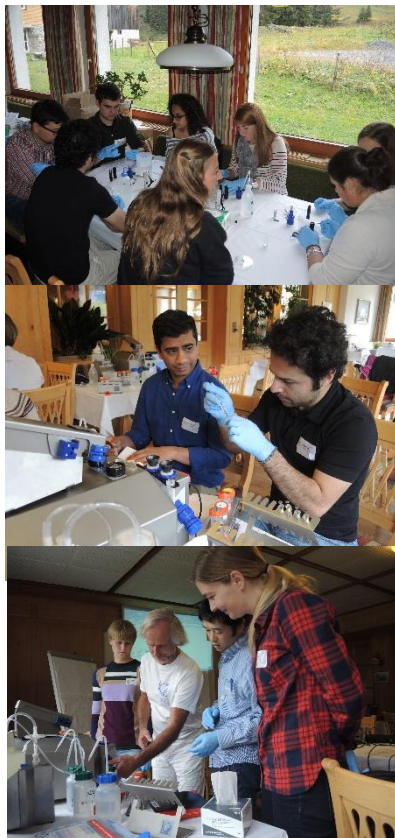


## 124<sup>th</sup> International Workshop on High-Resolution FluoRespirometry

2017 October 03 - October 08  
Schrócken, Vorarlberg, Austria



The **124<sup>th</sup> Workshop on High-Resolution FluoRespirometry (HRFR)** is the **38<sup>th</sup>** International Oxygen Course held in Schrócken since 1988. We provide an overview of the **O2k-FluoRespirometer**, with real-time analysis by **DatLab 7 (new)** and applications of the **TIP2k**. O2k-Demo experiments show the unique advantages and limitations of simultaneous monitoring of oxygen concentration, respiration, hydrogen peroxide production or mt-membrane potential. HEK 293T cells are used as a biological reference sample, which can be stored and shipped on dry-ice – introducing the MitoFit Proficiency Test. **Instrumental setup** and service of the polarographic oxygen sensor (**OroboPOS**) are demonstrated, followed by hands-on practice in 10 teams. A wide range of mitochondrial topics is covered; abstracts and experimental experiences are presented by participants.

IOC participants invariably asked for a detailed discussion of protocol design. The **Blue Book** provides a basic introduction to mitochondrial physiology and is complemented by overview presentations with examples, including **DatLab Analysis** of demo files. **Instrumental quality control** is a fundamental component of HRFR and will be put to the practical test in teams using seven O2k (14 chambers). The **O2k-MultiSensor** and particularly O2k-Fluorometry has become an integral part of the O2k-Workshop. Optimization of protocol design for various O2k-MultiSensor applications helps to critically evaluate basic principles of mitochondrial physiology. You will also see the **Titration-Injection microPump TIP2k** with feedback-control in action and practice its simple and automatic operation.

Lunch breaks provide an opportunity for relaxing Walks & Talks, enjoying the refreshing scenery of the secluded alpine environment or using spare time for individual practice. Join for a visit to the *Alpmuseum*.



## Lecturers and tutors

<a href="#">Gnaiger Erich</a>	CSO, Oroboros Instruments
<a href="#">Laner Verena</a>	COO, Oroboros Instruments
<a href="#">Chang Shao-Chiang</a>	Dep. Physical Therapy & Rehabilitation Science, Chang Gung Univ.
<a href="#">Velika Beata</a>	Dr., Pavol Jozef Šafárik University in Kosice, Republic Slovakia
<a href="#">Komlodi Tímea</a>	Dr., Oroboros Instruments - Scientific Researcher
<a href="#">Passrigger Manuela</a>	BSc., Oroboros Instruments - Biomedical Assistant



## Programme

### 1 Tuesday, Oct 03

\*printed in workshop materials

	Arrival	Weblink
<b>15:00</b>	<b>Arrival in Bregenz:</b> Meeting point Bregenz train station at 3:00 pm; approx. 1 h bus drive to Schröcken and Hoch-tannberg (Salober); walk to Hotel Körbersee (approx. 40 min)	<a href="#">IOC-travel</a>
18:30-19:30	<i>Welcome reception at Hotel Körbersee &amp; <b>get-together:</b></i> Introduction of participants and their research interests - a welcome by Oroboros Instruments	<a href="#">Schroecken</a>
19:30	<i>Dinner</i>	

### 2 Wednesday, Oct 04

	Workshop 1	Weblink
07:30-08:30	<i>Breakfast</i>	
<b>08:30-09:30</b>	<b>Challenges of innovation and continuation: transition to O2k-Series H and DatLab 7</b> O2k instrumental setup – overview with video clips	<a href="#">O2k-Videosupport</a>
<b>09:30-11:30</b>	<b>Hands-on (10 groups)</b> <b><u>O2k instrumental setup</u></b> <b><u>OroboPOS service</u></b>	<a href="#">O2k-Start</a> <a href="#">POS Service</a>
09:30-10:15	Groups 1-5                                      Groups 6-10	
10:15	<i>Coffee / Tea</i>	
	<b><u>O2k instrumental setup</u></b> <b><u>OroboPOS service</u></b>	<a href="#">POS Service</a> <a href="#">O2k-Start</a>
10:45-11:30	Groups 6-10                                      Groups 1-5	
<b>11:30-12:30</b>	<b>Oxygen calibration (instrumental quality control 1)</b> DL-Protocol O2-calibration air	<a href="#">Gnaiger 2008 POS</a> <a href="#">SOP: O2-calibration</a>
12:30	<i>Lunch packages/ Walk &amp; Talk</i> <i>Alternative: individual O2k-tasks</i>	
<b>14:30-15:30</b>	<b>Cell respiration and simultaneous measurement of H<sub>2</sub>O<sub>2</sub> production (Demo-Experiment)</b>	<a href="#">O<sub>2</sub>-Flux Analysis</a>
15:30	<i>Coffee / Tea</i>	

<b>16:00-18:00</b>	<b>Hands-on (7 groups): Oxygen calibration and cell respiration</b> Cell respiration and simultaneous measurement of H <sub>2</sub> O <sub>2</sub> production.	<a href="#">MiPNet15.09 Yeast reference assay</a>
18:30	<i>Dinner</i>	
<b>20:00-21:00</b>	<b>DatLab analysis:</b> Reproducibility of technical repeats	<a href="#">POS-Calibration-SOP O2 background</a>

### 3 Thursday, Oct 05

Workshop 2	Weblink
07:30-08:30 <i>Breakfast</i>	
<b>08:30-10:00</b> <b>Experimental design:</b> Pathway and coupling control of mitochondrial respiration	<a href="#">MitoPedia: Respiratory states</a>
10:00 <i>Coffee / Tea</i>	
<b>10:30-11:30</b> <b>O2k-Demo experiment:</b> Respiration of permeabilized cells: Measurement of oxygen consumption ( <a href="#">O2k-Core</a> ) with RP1 and RP2.	<a href="#">SUIT reference protocol</a>
<b>11:30-12:00</b> <b>Hands-on (7 groups) - getting started with an O2k experiment:</b> washing, stirrer test, air calibration	<a href="#">O2k-calibration</a>
12:00 <i>Lunch packages / Walk &amp; Talk</i> <i>alternative:</i> individual O2k-tasks	<a href="#">The Blue Book p 56*</a>
<b>14:00-16:00</b> <b>Hands-on (7 groups) - O2k-experiment</b> Respiration with permeabilized cells: SUIT protocols (RP1 and RP2) with 7 Power-O2k	<a href="#">SUIT Reference Protocols</a>
16:00 <i>Coffee / Tea</i>	
<b>16:30-17:45</b> <b>DatLab analysis and SUIT protocols</b> Flux per volume, flux per mass, flow per cell, flux control ratio, flux control factor	<a href="#">MitoPedia: Respiratory control ratios</a> <a href="#">MitoPedia: SUIT</a>
<b>17:45-18:45</b> <b>DatLab analysis: hands-on in teams</b> Analysis of the hands-on experiment with permeabilized cells.	<a href="#">DatLab Flux Analysis</a> <a href="#">MitoPedia: DatLab</a>
19:00 <i>Dinner + registration for the walk to the Alpmuseum</i>	
<b>20:30-21:30</b> <b>O2k perspectives:</b> 10+5 min presentations of abstracts 1-4	

### 4 Friday, Oct 06

Workshop 3	Weblink
07:30-08:30 <i>Breakfast</i>	
<b>08:30-09:00</b> <b>From isolated mitochondria to tissue fibres and tissue homogenate preparation:</b> The PBI-Shredder (Demonstration)	<a href="#">MiPNet17.03 Shredder vs Fibres</a>
<b>09:00-10:00</b> <b>Introduction to instrumental O2 background</b> (Demo-Experiment), using the TIP2k DL-Protocol: Instrumental O2 background_TIP2k.	<a href="#">SOP: O2 background TIP2k manual</a>
10:00 <i>Coffee / Tea</i>	
<b>10:30-12:00</b> <b>Instrumental quality control 2:</b> O2 background test with the TIP2k; analysis of oxygen flux; O2 background from air saturation to zero oxygen concentration; or for permeabilized muscle fibres in the high-oxygen range of 500 – 200 µM.	
12:00 <i>Lunch packages / walk &amp; talk</i> <i>alternative:</i> individual O2k-tasks	
<b>14:30-15:00</b> <b>Tutorial on the Bioblast wiki</b> <a href="http://www.bioblast.at">www.bioblast.at</a>	<a href="#">O2k-Network</a> <a href="http://www.bioblast.at">www.bioblast.at</a>
<b>15:00-16:00</b> <b>DatLab analysis: hands-on in teams</b>	<a href="#">DatLab Flux Analysis</a>
16:00 <i>Coffee / Tea</i>	

<b>16:30-17:15</b>	<b>DatLab analysis: summary discussion</b>	
<b>17:15-18:00</b>	<b>SUIT protocols</b>	<a href="#">MitoPedia: SUIT</a>
18:30	<i>Dinner</i>	
<b>20:00-21:15</b>	<b>O2k perspectives: 10+5 min presentations of abstracts 5-9</b>	

## 5 Saturday, Oct 07

Workshop 4		Weblink
07:30-08:30	<i>Breakfast</i>	
<b>08:30-10:00</b>	<b>Hands-on (7 groups): Coupling control protocol for intact cells in 7 O2ks</b> Advanced groups: CCP for intact cells with measurement of H <sub>2</sub> O <sub>2</sub> .	<a href="#">Coupling control protocol</a>
10:00	<i>Coffee / Tea</i>	<a href="#">MiPNet18.10 O2kvsMultiwell*</a>
<b>10:30-12:00</b>	<b>Data analysis</b>	<a href="#">The Blue Book* pp 43-57</a>
12:00	<i>Lunch packages</i>	
12:30-15:30	<i>Walk to the Alpmuseum - guided tour and reception: € 15.-</i>	<a href="#">Alpmuseum*</a>
15:30	<i>Coffee / Tea</i>	
<b>16:00-17:00</b>	<b>Working groups: elaborate answers to the 'Questions for the O2k-Workshop' - come prepared</b>	<a href="#">IOC-Questions*</a>
<b>17:00-17:45</b>	<b>IOC-questions - discussion of 'Answers', introduction to O2k-technical support</b>	<a href="#">O2k-technical support</a>
<b>17:50-18:45</b>	<b>OXPHOS analysis: diagnosis of respiratory defects</b>	
19:00	<i>Dinner</i>	
20:00	<i>Feedback discussion: Next steps in the individual projects</i>	

## 6 Sunday, Oct 08

Departure	
06:30-7:30	<i>Breakfast</i>
<b>Early morning: departure from Hotel Körbersee at 08:15 am, bus departure 9.00 am at Salober.</b>	

## O2k-Workshop: OUR COMMON AIMS

- **Mitochondrial physiology:**  
Study mitochondrial function in the **context** of cell physiology and pathology
- **Instrumental performance – the O2k:**
  - 🕒 Learn **high**-resolution respirometry
  - 🕒 Gain **hands-on** experience
  - 🕒 Extend to O2k-**Multi** Sensor applications
- **Excellence in research:**
  - 🕒 Instrumental **quality** control
  - 🕒 Experimental design for **innovation**
  - 🕒 Data analysis meeting superior **standards**



## Participants

Participant	Institution
<a href="#">Panajatovic Miljenko</a>	<b>CH Basel Kraehenbuehl S:</b> University hospital Basel (CH)
<a href="#">Di Nunzio Giada</a>	<b>PT Coimbra Carvalho E:</b> University of Coimbra (PT)
<a href="#">Nozickova Katerina</a>	<b>CZ Hradec Kralove Cervinkova Z:</b> Charles University in Prague (CZ)
<a href="#">Bailey Stephen</a>	<b>UK Loughborough Bailey S:</b> Loughborough University (UK)
<a href="#">Gumpp Anja</a>	<b>DE Ulm Karabatsiakis A:</b> Clinical & Biological Psychology Ulm University (DE)
<a href="#">Safaei Zahra</a>	<b>AT Innsbruck Oroboros:</b> Iran university of medical sciences and health services (IR)
<a href="#">Viriding Susanne</a>	<b>SE Stockholm Freyer C:</b> Karolinska Institutet, Stockholm (SE)
<a href="#">Chung Eunhee</a>	<b>US TX San Antonio Chung E:</b> The University of Texas at San Antonio (US)
<a href="#">Cyr Anthony</a>	<b>US PA Pittsburgh Zuckerbraun BS:</b> University of Pittsburgh, PA (US)
<a href="#">Martins Luis</a>	<b>UK London Carling D:</b> MRC London Institute of Medical Sciences (UK)
<a href="#">Fernandez-Oriz Marisol</a>	<b>ES Granada Acuna-Castroviejo D:</b> University of Granada (ES)
<a href="#">Woyda-Ploszczyca Andrzej</a>	<b>PL Poznan Jarmuszkiewicz W:</b> Adam Mickiewicz University, Poznan (PL)
<a href="#">Kwon Oh Sung</a>	<b>US UT Salt Lake City Layec G:</b> University of Utah, UT (US)
<a href="#">Koziel Agnieszka</a>	<b>PL Poznan Jarmuszkiewicz W:</b> Adam Mickiewicz University, Poznan (PL)
<a href="#">Swaminathan Dhanapal</a>	<b>AE Dubai Swaminathan D:</b> Dubai Equine Hospital (AE)
<a href="#">Slivka Dustin R</a>	<b>US NE Omaha Slivka DR:</b> University of Nebraska at Omaha (US)
<a href="#">Park Song-Young</a>	<b>US NE Omaha Slivka DR:</b> University of Nebraska at Omaha (US)
<a href="#">Sokolov Evgeny</a>	<b>DE Rostock Sokolova I:</b> Universtiy of Rostock (DE)
<a href="#">Pereira da Silva Grilo da Silva F</a>	<b>PT Cantanhede Oliveira PJ:</b> University of Coimbra (PT)
<a href="#">Schartner Melanie</a>	<b>AT Innsbruck Oroboros:</b> Medical University of Innsbruck (AT)
<a href="#">De La Rosa Livier</a>	<b>FR Paris Wai T:</b> Faculté de Médecine, Paris (FR)
<a href="#">Bastos Sant'Anna Silva Ana Carolina</a>	<b>AT Innsbruck Oroboros:</b> Oroboros Instruments, Innsbruck (AT)
<a href="#">Pranger Florian</a>	<b>AT Innsbruck Oroboros:</b> Oroboros Instruments, Innsbruck (AT)

\*Asteriks indicate the number of O2k instruments in the participant's lab.

## OROBOROS: O2k in numbers



- **25 years** - since 1992
- **>900** instruments world-wide
- **>570** O2k-Network Labs in 49 countries
- **>2,200** O2k-Publications: [www.oroboros.at](http://www.oroboros.at)
- **OROBOROS-Team: 20**
- **122** O2k-Workshops



## MiPNet22.01 Abstracts IOC124: 10+5 min O2k perspectives

### 1. Agnieszka Koziel, Karolina Ogradna, Wieslawa Jarmuszkiewicz (2017) The influence of chronic exposure to hypoxia on mitochondrial oxidative metabolism in human endothelial EA.hy926 cell. Mitochondr Physiol Network 22.07.

Endothelium is a monolayer of cells lining each blood vessel. Disturbances of endothelial functions are implicated in the development of many cardiovascular diseases. In endothelial cells, the ATP synthesis occurs in a major part via a glycolytic pathway. The slight dependence of endothelial cells on mitochondrial oxidative phosphorylation could suggest that mitochondria play no significant role in these cells. The general goal of our research is to study the aerobic metabolism of endothelial cells under physiological and pathophysiological conditions. The goal of this study was to determine mitochondrial respiratory function in endothelial cells and isolated mitochondria and assess the influence of chronic hypoxia on the aerobic metabolism of these cells. Human umbilical vein endothelial cells (EA.hy926 cell line) were cultured for 6 days at 20% and 1% O<sub>2</sub> concentrations.

In endothelial cells, chronic hypoxia provoked a shift from aerobic toward anaerobic catabolic metabolism. Growth of endothelial cells at 1% O<sub>2</sub> tension did not change endothelial cells viability and mitochondrial biogenesis. However, elevated fermentation was observed. Under hypoxic conditions, mitochondrial respiration during carbohydrate, fatty acid and amino acid oxidation were declined, but ketogenic amino acid oxidation were increased. Hypoxia led to increased reactive oxygen species (ROS) generation (intracellular and mitochondrial), although antioxidant defence (superoxide dismutases SOD1 and SOD2, and uncoupling proteins, UCPs) were not escalated. Moreover, decreased UCP2 activity and expression were observed.

Furthermore, in mitochondria from hypoxic cells, increased expression and activity of complex II, and decreased expression and activity of complex I were observed. The increased activity of complex II resulted in an elevation in succinate-sustained mitochondrial ROS generation, mainly through increased reverse electron transport.

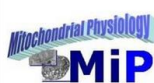
Chronic exposure to hypoxia lead to numerous changes in aerobic metabolism of endothelial cells. Endothelial mitochondria play a significant role in response to metabolic adaptation related to hypoxia. Our results point out an important role of succinate, complex II, and reverse electron transport in hypoxia adaptation of endothelial cells. Mitochondrial ROS could play significant signalling role in endothelial cells under hypoxic conditions.

2. **Woyda-Ploszczyca A.M. and Jarmuszkiewicz W (2017) GDP-induced oxidative phosphorylation alleviates the GDP-dependent inhibitory effect on mitochondrial proton leak. Mitochondr Physiol Network 22.07.**

The purine nucleotide GDP is commonly used as a diagnostic inhibitor of mitochondrial uncoupling proteins (UCPs). UCPs belong to the mitochondrial carrier family and play the role of main catalysts of futile proton leak of the proton electrochemical gradient generated by the respiratory chain. However, we found that a high concentration of GDP (1 mM), but not GTP, stimulates respiratory rate and decreases membrane potential of mammalian (rat kidney and human endothelial cells) [Woyda-Ploszczyca and Jarmuszkiewicz, 2014], plant (potato tubers), as well as unicellular eukaryote (amoeba) isolated mitochondria [Woyda-Ploszczyca and Jarmuszkiewicz, 2017]. Therefore, we have observed exactly an opposite effect than that expected for the UCP-mediated H<sup>+</sup> leak inhibition where an oxygen consumption rate inhibition is accompanied by an increase in mitochondrial membrane potential. We obtained the GDP stimulatory effect both in the absence and presence of exogenous free fatty acids (linoleic acid) considered strong positive effectors of UCP homologues. Interestingly, under conditions excluding oxidative phosphorylation, i.e. in the presence of carboxyatractyloside and/or oligomycin, the GDP stimulatory effect was completely abolished. We propose that the GDP-induced stimulatory effect depends on nucleoside diphosphate kinase (NDPK) activity. This enzyme transphosphorylates GDP in the presence of ATP and generates ADP pool (ATP + GDP → ADP + GTP) what subsequently induces oxidative phosphorylation. Our results indicate that the GDP-dependent inhibition of UCPs could have a minor physiological significance and consequently GDP should not be used as a diagnostic inhibitor of UCPs.

3. **Miljenko Panajatovic, François Singh, Stephan Krähenbühl, and Jamal Bouitbir (2017) Role of PGC-1 $\alpha$  associated mitochondrial biogenesis in statin-induced myotoxicity. Mitochondr Physiol Network 22.07.**

At the request of the authors, this abstract is not made available online.



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## MiP2017/MitoEAGLE Hradec Kralove CZ



Hradec Kralove CZ, 15-18 Nov 2017. 12<sup>th</sup> Conference on Mitochondrial Physiology: The role of mitochondria in lifestyle and metabolic syndrome - COST MitoEAGLE perspectives.



## Accommodation and location

**Hotel Körbersee** [www.koerbersee.at](http://www.koerbersee.at)  
T +43 5519 265 [hotel@koerbersee.at](mailto:hotel@koerbersee.at)



## More detail?

Gnaiger E (2014) Mitochondrial pathways and respiratory control. An introduction to OXPHOS analysis. 4th ed. Mitochondr Physiol Network 19.12. Oroboros MiPNet Publications, Innsbruck: 80 pp. » [Full text in Bioblast](#)

**O2k-Manual** – <http://wiki.oroboros.at/index.php/O2k-Manual>

**O2k-Protocols** – <http://wiki.oroboros.at/index.php/O2k-Protocols>

**>2,200 O2k-Publications** – <http://wiki.oroboros.at/index.php/O2k-Publications: Topics>

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## Contact

Erich Gnaiger, PhD  
Medical University of Innsbruck  
D. Swarovski Research Laboratory  
A-6020 Innsbruck, Austria  
[www.mitofit.org](http://www.mitofit.org)

Oroboros Instruments  
Schöpfstrasse 18  
A-6020 Innsbruck, Austria  
T +43 512 566796 F +43 512 566796 20  
[instruments@oroboros.at](mailto:instruments@oroboros.at) | [www.oroboros.at](http://www.oroboros.at)  
**Mitochondria and cell research**

O2k-Workshops are listed as [MitoGlobal Events](#)

